TC425G82 G822000 enc.1

Guadalupe Creek Restoration Project,
Almaden Expressway to Masson Dam
Engineer's Report

Prepared by:

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686
408.265.2607

November 22, 2000

Jones & Stokes

TC
425
G82.G82
2000en
c.1
LIBRARY

Table of Contents

Page

Chapter 1. Introduction 1-1
1.1 PURPOSE OF THIS REPORT 1-1
1.2 PROJECT LOCATION 1-2
1.3 OBJECTIVES 1-2
1.3.1 Primary Objective 1-3
1.3.2 Secondary Objectives 1-3

Chapter 2. Related Projects, Programs, and Regulations 2-1
2.1 SANTA CLARA VALLEY WATER DISTRICT 2-1
2.1.1 Habitat Conservation Plan 2-1
2.1.2 Guadalupe Fisheries Management Plan 2-1
2.1.3 Downtown Guadalupe River Flood Protection Project (Downtown Project) 2-2
2.1.4 Upper Guadalupe River Flood Protection Project 2-3
2.1.5 Lower Guadalupe River Flood Protection Project 2-5
2.1.6 Stream Maintenance Program 2-8
2.2 OTHER REGIONAL EFFORTS 2-8
2.2.1 Santa Clara County General Plan 2-8
2.2.2 Santa Clara County Countywide Trails Master Plan Update 2-9
2.2.3 City of San Jose 2020 General Plan 2-9
2.2.4 Santa Clara Basin Watershed Management Initiative 2-10
2.2.5 Santa Clara Valley Urban Runoff Pollution Prevention Program 2-10
2.2.6 City of San Jose – Riparian Corridor Policy Study 2-10
2.2.7 City of San Jose – Riparian Restoration Action Plan 2-11
2.2.8 San Francisco Bay Regional Water Quality Control Board and State Water Resources Control Board Water Quality Control Plan . . 2-11
2.2.9 Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) 2-12
2.3 STATE REGULATIONS 2-12
2.3.1 California Environmental Quality Act 2-12
2.3.2 California Fish and Game Code, Sections 1601–1607 (Lake or Streambed Alteration Agreement Program) 2-13
2.3.4 California Air Quality Regulations 2-14
2.3.5 California Hazardous Materials Regulations 2-14
2.3.6 Porter-Cologne Water Quality Control Act 2-15
2.4 FEDERAL REGULATIONS 2-15
2.4.1 National Environmental Policy Act 2-15
2.4.2 Endangered Species Act, Sections 7, 9, and 10 2-15

2.4.3 Magnuson-Stevens Fishery Conservation and Management Act 2-16
2.4.4 Clean Water Act 2-17
2.4.5 Clean Air Act 2-19
2.4.6 National Historic Preservation Act, Section 106 2-19
2.4.7 Executive Order 11990, Protection of Wetlands 2-20
2.4.8 Executive Order 12898, Environmental Justice 2-20
2.4.9 Migratory Bird Treaty Act 2-20
2.4.10 Comprehensive Environmental Response, Compensation, and Liability Act 2-21
2.4.11 Resource Conservation and Recovery Act 2-21

Chapter 3. Project Area Background 3-1
3.1 GEOMORPHOLOGY, HYDROLOGY, AND HYDRAULICS 3-1
3.1.1 Geomorphology 3-1
3.1.1.1 Introduction 3-1
3.1.1.2 Physiography 3-2
3.1.1.3 Project Area 3-3
3.1.1.4 Historical Geomorphology 3-6
3.1.1.5 Historical and Future Trends 3-13
3.1.1.6 Summary and Conclusions 3-15
3.1.2 Hydrology 3-16
3.1.2.1 Hydrologic Setting 3-16
3.1.2.2 Flow Frequency 3-20
3.1.2.3 Flow Duration 3-21
3.1.3 Hydraulics 3-23
3.1.3.1 Introduction 3-23
3.1.3.2 Creek Description 3-23
3.1.3.3 Model Setup 3-23
3.1.3.4 HEC-RAS Model Results 3-25
3.1.3.5 Reach-Averaged Sediment Transport Capacities 3-28
3.2 SOILS AND GROUNDWATER HYDROLOGY 3-30
3.2.1 Soils 3-30
3.2.2 Groundwater Hydrology 3-31
3.2.2.1 Project Area 3-32
3.2.2.2 Upstream Area between Masson Dam and Camden Avenue . 3-32
3.3 VEGETATION 3-33
3.3.1 Historic Vegetation 3-33
3.3.1.1 Data Sources 3-33
3.3.1.2 Presumed Pre-European Riparian Vegetation 3-33
3.3.1.3 Native American Traditional Resource Management 3-34
3.3.1.4 Early European Settlement 3-35
3.3.1.5 Twentieth Century Developments 3-35
3.3.2 Existing Vegetation 3-37
3.3.2.1 Plant Community Classification 3-37
3.3.2.2 Major Plant Associations within the Project Area 3-38
3.3.2.3 Vegetation Occurring along Geomorphic Reaches 3-39

3.3.2.4 Reach 1 3-39
3.3.2.5 Reach 2 3-39
3.3.2.6 Reach 3 3-39
3.3.2.7 Reach 4 3-40
3.3.2.8 Nonnative Invasive Plant Species 3-40
3.3.3 Natural Recruitment of Native Plants 3-40
3.3.3.1 Limits on Natural Recruitment and Propagule Availability . 3-40
3.3.3.2 Natural Recruitment Plan Guilds 3-41
3.3.4 Guadalupe Creek Phase 1 Planting Survey 3-42
3.3.4.1 First-Year Survey Results of Phase 1 Planting 3-42
3.3.5 Project Area Constraints - Trends Without Project 3-42
3.3.5.1 Project Area Conditions 3-42
3.3.5.2 Plant Recruitment 3-43
3.3.5.3 Water Availability 3-43
3.3.5.4 Soil Condition 3-43
3.3.5.5 Depth to Groundwater 3-43
3.3.5.6 Wetted Perimeter along Low-Flow Channel 3-43
3.3.5.7 Sediment Accretion 3-44
3.3.5.8 Loss of Large Sycamores 3-44
3.3.5.9 Invasive Weeds 3-44
3.4 FISHERIES 3-44
3.4.1 Fish Occurrence 3-44
3.4.1.1 Steelhead 3-44
3.4.1.2 Chinook Salmon 3-46
3.4.1.3 Other Species 3-47
3.4.2 Habitat Structure 3-48
3.4.2.1 Overhead Cover 3-48
3.4.2.2 Instream Cover 3-48
3.4.2.3 Pool Habitat 3-49
3.4.2.4 Riffle/Run Habitat 3-50
3.4.2.5 Spawning Gravel 3-51
3.4.2.6 Water Temperature 3-51
3.5 LAND USE, INFRASTRUCTURE, AND PUBLIC HEALTH AND SAFETY . 3-52
3.5.1 Land Use 3-52
3.5.1.1 City of San Jose Property 3-53
3.5.1.2 Los Capitancillos Freshwater Wetland Mitigation Site 3-53
3.5.1.3 Recreational Uses 3-54
3.5.2 Infrastructure 3-54
3.5.2.1 Los Capitancillos Percolation Ponds 3-54
3.5.2.2 Flood Control Project 3-54
3.5.2.3 Roads and Bridges 3-55
3.5.2.4 Other Utilities and Infrastructure 3-55
3.5.3 Public Health and Safety 3-56
3.5.3.1 Flood Control 3-56
3.5.3.2 Mosquito and Vector Control 3-56
3.5.3.3 Mercury 3-56

3.6 CULTURAL RESOURCES 3-58
  3.6.1 Prehistory and Ethnography 3-58
  3.6.2 History 3-59
  3.6.3 Mining Activities 3-59

Chapter 4. Restoration Project Elements 4-1
4.1 GEOMORPHOLOGY, HYDROLOGY, AND HYDRAULICS CRITERIA 4-1
  4.1.1 Topic 1. Channel Stability 4-1
    4.1.1.1 Subtopic 1A. Channel Form 4-1
    4.1.1.2 Subtopic 1B. Floodplain Creation 4-2
    4.1.1.3 Subtopic 1C. Sediment Transport Capacity 4-3
    4.1.1.4 Subtopic 1D. Stabilization Measures 4-4
  4.1.2 Topic 2. Channel Complexity 4-5
4.2 SOILS AND GROUNDWATER 4-5
  4.2.1 Topic 1. Depth to the Water Table 4-5
  4.2.2 Topic 2. Coarse-Textured Soil and High Coarse Fragment Content . . . 4-6
  4.2.3 Topic 3. Hard and Cemented Soil 4-6
4.3 VEGETATION 4-6
  4.3.1 Topic 1. Site Preparation 4-6
  4.3.2 Topic 2. Planting 4-7
    4.3.2.1 Subtopic 2A. Plant Species Composition 4-7
    4.3.2.2 Subtopic 2B. Plant Collection, Propagation, Storage, and Delivery 4-8
    4.3.2.3 Subtopic 2C. Planting Techniques 4-9
  4.3.3 Topic 3. Irrigation 4-9
  4.3.4 Topic 4. Plant Establishment/Maintenance 4-10
  4.3.5 Topic 5. Erosion Control 4-10
4.4 FISH HABITAT 4-10
  4.4.1 Topic 1. Overhead Cover 4-10
  4.4.2 Topic 2. Instream Cover 4-11
  4.4.3 Topic 3. Pool Habitat 4-12
  4.4.4 Topic 4. Riffle/Run Habitat 4-13
  4.4.5 Topic 5. Water Temperature 4-14
4.5 LAND USE, INFRASTRUCTURE, AND PUBLIC HEALTH AND SAFETY . 4-15
  4.5.1 Topic 1. Land Use 4-15
  4.5.2 Topic 2. Existing Facilities 4-15
  4.5.3 Topic 3. Public Health and Safety 4-16
    4.5.3.1 Subtopic 3A. Flood Control 4-16
    4.5.3.2 Subtopic 3B. Mosquito and Vector Control 4-16
    4.5.3.3 Subtopic 3C. Toxic Constituents – Mercury 4-16
4.6 CIVIL ENGINEERING 4-17
  4.6.1 Topic 1. Design Standards 4-17
  4.6.2 Topic 2. Construction Planning 4-17
  4.6.3 Topic 3. Traffic Control and Access to Work 4-18
  4.6.4 Topic 4. Earthwork 4-18
  4.6.5 Topic 5. Temporary Erosion Control 4-19

4.6.6 Topic 6. Stream Diversion 4-20

Chapter 5. Project Alternatives and Recommended Project 5-1
5.1 ALTERNATIVES CONSIDERED 5-1
5.1.1 Alternative 1: Channel and Floodplain Modification Alternative 5-1
5.1.1.1 Reach 1 5-2
5.1.1.2 Reach 2 5-2
5.1.1.3 Reach 3 5-3
5.1.1.4 Reach 4 5-3
5.1.1.5 Cost 5-4
5.1.2 Alternative 2: Reduced Channel and Floodplain Modification 5-4
5.1.2.1 Reach 1 5-4
5.1.2.2 Reach 2 5-5
5.1.2.3 Reach 3 5-6
5.1.2.4 Reach 4 5-6
5.1.2.5 Cost 5-7
5.1.3 Alternative 3: Minimal Channel and Floodplain Modification Alternative 5-7
5.1.3.1 Reach 1 5-7
5.1.3.2 Reach 2 5-8
5.1.3.3 Reach 3 5-8
5.1.3.4 Reach 4 5-8
5.1.3.5 Cost 5-9
5.1.4 Alternative 4: No-Project Alternative 5-9
5.2 EVALUATION OF ALTERNATIVES 5-9
5.3 SELECTION OF THE RECOMMENDED PROJECT 5-9
5.4 BEST MANAGEMENT PRACTICES 5-10
5.4.1 Vegetation Protection Measures 5-10
5.4.2 Storm Water Pollution Prevention Plan 5-11
5.4.2.1 Erosion and Sediment Control Measures 5-11
5.4.2.2 Spill Prevention and Response Plan 5-12
5.4.3 Soil Management Measures 5-13
5.4.4 Construction Period Limits 5-14
5.4.5 Construction-Area Fish Management Measures 5-14
5.4.6 Measures to Comply with Migratory Bird Treaty Act 5-15
5.4.7 Measures to Implement Bay Area Air Quality Management District's Feasible Control Measures for PM10 Emissions from Soil Removal Activities 5-15
5.4.8 Measures to Address Traffic-Related Effects 5-16
5.4.9 Measures to Address Cultural Resources 5-16
5.4.10 Measures to Address Noise-Related Effects 5-17

Chapter 6. Maintenance Program 6-1
6.1 MONTHLY MAINTENANCE 6-1
6.2 MATERIALS AND PLACEMENT 6-2
6.3 WEED CONTROL 6-2

6.4 IRRIGATION OPERATION 6-2
6.5 REPLACEMENT PLANTING 6-3
6.7 PLANT ESTABLISHMENT FORMS 6-4
6.8 MONITORING 6-4

Chapter 7. Project Cost, Funding, and Schedule 7-1
7.1 COST 7-1
7.2 FUNDING 7-1
7.3 SCHEDULE 7-1

Chapter 8. Conclusions and Recommendations 8-1

Chapter 9. Citations 9-1
9.1 PRINTED REFERENCES 9-1
9.2 PERSONAL COMMUNICATIONS 9-7

Appendix A. Baseline Condition Maps
Appendix B. Ground Survey Cross Section Locations
Appendix C. Draft Submittal – Guadalupe Creek Restoration Plans
Appendix D. Cost Estimates for Project Alternatives and Recommended Project

List of Tables

Table **Page**

2-1 Summary of Objectives for Relevant Projects, Programs, and Regulations 2-2

3-1 Historical Aerial Photographs 3-2
3-2 Historical Topographic Maps 3-2
3-3 Reach-Averaged Hydraulic Characteristic of Geomorphic Reaches for 2-Year and 100-Year Flood Events 3-6
3-4 Inventory of Streamflow Gage Data for Guadalupe Creek 3-18
3-5 Peak Flow Comparison for Guadalupe Creek 3-21
3-6 HEC-RAS Hydraulic Output Summary for Guadalupe Creek 3-26
3-7 Reach-Averaged Hydraulic Characteristics for Guadalupe Creek 3-27
3-8 Potential Soil and Hydrologic Constraints of Soil Map Units Located within the Guadalupe Creek Project Area 3-32
3-9 Summary of Groundwater, Surface-Water and Ground-Surface Elevational Data for Soil Test Pits and Piezometers Located within the Guadalupe Creek Project Area 3-32
3-10 Summary of Groundwater, Surface-Water, and Ground-Surface Elevational Data for Soil Test Pits and Piezometers Located Upstream from the Guadalupe Creek Project Area between Masson Dam and Camden Avenue . 3-32
3-11 Dominant Woody Plant Growth and Reproduction 3-42
3-12 Phase 1 Revegetation Summary for Guadalupe Creek 3-42
3-13 Temperature Requirements (°F) for Life Stages of Chinook Salmon and Steelhead during the Months Present in the Guadalupe River 3-45
3-14 Pool Types and Design Considerations 3-50
3-15 Results of June–July 2000 Mercury Analyses of Bank Soils at Proposed Project Site 3-57
3-16 Results of September 2000 Mercury Analyses of Bank Soils 3-58

4-1 Benefits of Floodplain Creation and Increasing Channel Complexity 4-8

5-1 Extent to Which the Alternatives Meet the Project Objectives 5-10
5-2 Comparison of Features Associated with the Project Alternatives 5-10

7-1 Construction Cost Estimate for the Recommended Project 7-2

List of Figures

Figure **Page**

1-1 Lower Guadalupe Creek Project Area 1-2

3-1 Guadalupe Creek Drainage Basin and Project Area 3-2
3-2 Geologic Units in Immediate Vicinity of Project Area 3-4
3-3 Delineation of Geomorphic Reaches in Lower Guadalupe Creek Project Area 3-4
3-4 Historical Timeline of Significant Events on Lower Guadalupe Creek 3-6
3-5 Planform Shift Map of Lower Guadalupe Creek 3-10
3-6 Map Showing Multiple Flow Channels in 1871 Alignment of Guadalupe Creek 3-10
3-7 Comparison of 1939 and 1999 Aerial Photographs of Project Area on Lower Guadalupe Creek 3-10
3-8 Comparison of 1939 and 1980 Aerial Photographs of Lower Guadalupe Creek 3-10
3-9 Channel Bed Profile Data of Project Reaches from 1933, 1972, and 1999 3-12
3-10 Station Locations of 1972 and 1999 Cross Section Comparisons 3-12
3-11 Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 18+00 3-12
3-12 Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 29+20 3-12
3-13 Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 39+20 3-12
3-14 Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 45+20 3-12
3-15 Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 49+40 3-12
3-16 Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 66+40 3-12
3-17 Guadalupe Creek Water Distribution System 3-20
3-18 Annual Peak Discharges Recorded at Streamflow Gage 43 3-20
3-19 Annual Flow Frequency Curve for Streamflow Gage 43 3-20
3-20 Flow Duration Curve for Streamflow Gage 43 3-22
3-21 Computed 2-, 10-, and 100-Year Water-Surface Profiles 3-26
3-22 Computed Velocity Profile 3-26
3-23 Computed Active Channel Widths 3-26
3-24 Computed 100-Year Water-Surface Profile Comparison 3-28
3-25 Pebble Count Particle Sizes 3-28
3-26 Sediment Transport Capacities 3-30
3-27 Relative Ground-Surface and Groundwater Elevations at Soil Test Pits S19 and S20 3-32
3-28 Relative Ground-Surface and Groundwater Elevations at

Soil Test Pits S16 and S17 3-32
3-29 Relative Ground-Surface and Groundwater Elevations at
Soil Test Pits S9 and S10 3-32
3-30 Relative Ground-Surface and Groundwater Elevations at
Soil Test Pits S5 and S21 3-32
3-31 Historical Comparison of Guadalupe Creek Reach 1 3-36
3-32 Historical Comparison of Guadalupe Creek Reaches 2 and 3 3-36
3-33 Historical Comparison of Guadalupe Creek Reach 4 and
Upstream to Camden Avenue 3-36

4-1 Cross-Section Showing Planting Zones 4-8

5-1 Delineation of Geomorphic Reaches in Guadalupe Creek Project Area 5-2
5-2 Alternative 1 – Reach 1 5-2
5-3 Alternative 1 – Reach 2 5-2
5-4 Alternative 1 – Reach 3 5-2
5-5 Alternative 1 – Reach 4 5-2
5-6 Alternative 1 – Typical Cross Section 5-2
5-7 Alternative 2 – Reach 1 5-4
5-8 Alternative 2 – Reach 2 5-4
5-9 Alternative 2 – Reach 3 5-4
5-10 Alternative 2 – Reach 4 5-4
5-11 Alternative 2 – Typical Cross Section 5-4
5-12 Alternative 3 – Reach 1 5-8
5-13 Alternative 3 – Reach 2 5-8
5-14 Alternative 3 – Reach 3 5-8
5-15 Alternative 3 – Reach 4 5-8
5-16 Alternative 3 – Typical Cross Section 5-8

Chapter 1. Introduction

The Santa Clara Valley Water District (District) is proposing to establish shaded riverine aquatic (SRA) cover vegetation and improve aquatic habitat in the lower reaches of Guadalupe Creek between Almaden Expressway and Masson Dam. The Guadalupe Creek Restoration Project is intended to provide SRA mitigation to offset environmental impacts associated with future District projects.

Planting of SRA cover vegetation along Guadalupe Creek was separated into two phases. Phase 1, located at the upstream end of the project area, was installed during the winter of 1998–1999 and included planting 1,253 linear feet (lf) of riparian vegetation along both sides of the creek. Phase 2, located between Almaden Expressway and the Phase 1 planting site, is scheduled to be implemented in fall 2000 and will include planting 10,791 lf of riparian vegetation along both sides of the creek.

1.1 PURPOSE OF THIS REPORT

This Engineer's Report presents the restoration project background, integrated programs in the project watershed, restoration project elements, the alternative solutions analyzed, a recommended project, and environmental impacts and mitigation required. This report has been prepared in accordance with Section 10 of the District Act which requires an Engineer's Report for projects that are to be funded with District revenues. This Engineer's Report includes:

- related projects, programs, and regulations (Chapter 2);
- restoration project background (Chapter 3);
- restoration project elements (Chapter 4);
- alternative solutions and recommended project, including environmental impacts and mitigation required (Chapter 5);
- description of the maintenance program (Chapter 6);
- project cost, financing, and staging (Chapter 7);

- conclusions and recommendations (Chapter 8); and

- citations (Chapter 9).

In addition to this Engineer's Report, an environmental impact report/environmental impact statement (EIR/EIS) has been prepared to address potential environmental effects of the Guadalupe Creek Restoration Project. It contains a more detailed discussion of the environmental impacts and mitigation. The EIR/EIS will support decision making by the District, the U.S. Army Corps of Engineers (Corps), and other responsible and cooperating agencies to implement the project and ensure compliance with the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), and other pertinent laws and regulations. The EIR/EIS is bound with the Engineer's Report.

Public hearings will be held on this Engineer's Report and EIR/EIS and comments will be solicited from the community and responsible agencies. The District Board of Directors will then decide what action, if any, to take.

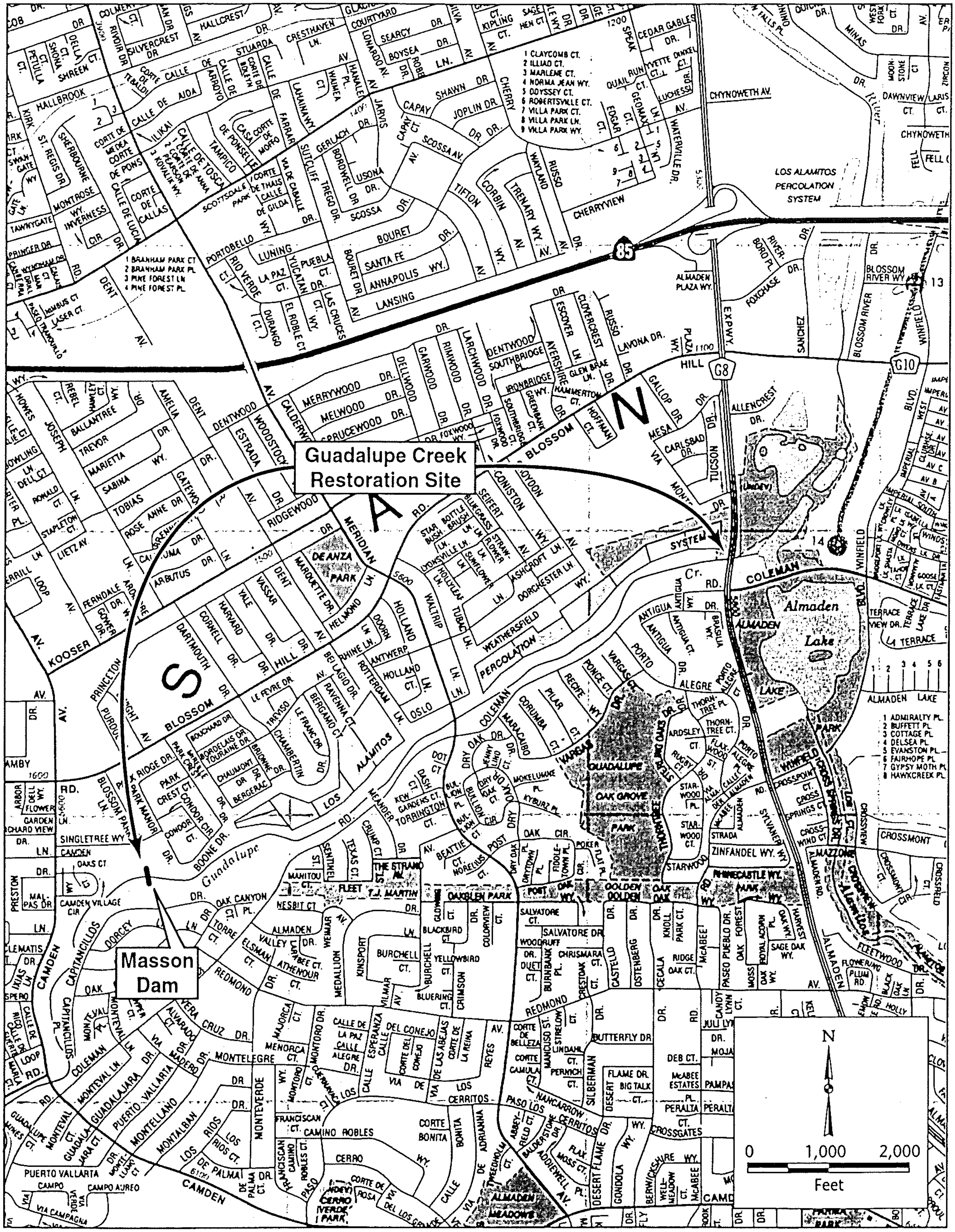
1.2 PROJECT LOCATION

Guadalupe Creek is located in the southwestern portion of the City of San Jose (the City) in Santa Clara County (the County). The project area for resources evaluated in this document encompasses approximately 1.7 miles of lower Guadalupe Creek between Masson Dam and Almaden Expressway. The project area is bordered on the north by residential development and the Los Capitancillos percolation pond system, and on the south by Coleman Road (Figure 1-1).

More detailed description of the geomorphic soil and vegetation characteristics of the project area are provided in Chapter 3.

1.3 OBJECTIVES

The objectives of the Guadalupe Creek Restoration Project were developed in phases during a series of meetings involving the District and project stakeholders. A preliminary set of project objectives was presented to the public at an open house held on February 17, 2000. After a thorough review of comments received at the open house, the project objectives were refined and a final set of primary and secondary objectives was articulated to guide the formulation and evaluation of alternatives.



Jones & Stokes

Figure 1-1
Lower Guadalupe Creek Project Area

1.3.1 Primary Objective

The primary objective of the project is to restore shaded riverine aquatic (SRA) cover vegetation and improve aquatic habitat for anadromous fish (e.g., steelhead) in lower Guadalupe Creek, between Almaden Expressway and Masson Dam. Restoring SRA cover vegetation and improving aquatic habitat would create and maintain suitable water temperatures, increase organic material (e.g., leaf and insect drop), and provide habitat to support all life stages of anadromous fish.

1.3.2 Secondary Objectives

Secondary project objectives represent key physical, ecological, regulatory, and societal benefits other than the project's primary objective that may be achieved through project implementation. Expected success in achieving these secondary project objectives was used to evaluate potential project alternatives and to identify alternatives for detailed consideration in this document. The project's secondary objectives are:

- to create 5,915 linear feet of SRA cover vegetation, that may serve as off-site mitigation for impacts of the Guadalupe River Flood Protection;
- to create riparian habitat, including SRA cover vegetation, that may provide mitigation credit for future District projects, or may represent "enhancement opportunities" resulting in a net increase in biological resources in the project area, consistent with District policy;
- to enhance habitat for other special-status species;
- to restore physical processes and ecological functions along the project reach of Guadalupe Creek;
- to protect existing infrastructure in the project area;
- to maintain existing flood conveyance capacity;
- to minimize impacts on existing resources;
- to improve recharge of groundwater aquifers;
- to minimize long-term operations and maintenance requirements;
- to minimize impacts on existing water management operations;

- to strive to meet regional planning objectives as outlined in relevant regional planning documents; and
- not to preclude future recreation uses that are compatible with other project objectives.

Chapter 2. Related Projects, Programs, and Regulations

2.1 SANTA CLARA VALLEY WATER DISTRICT

This chapter describes related projects, programs, and regulations as they apply to Guadalupe Creek. Table 2-1 summarizes objectives from relevant projects, programs, and regulations as they apply to Guadalupe Creek.

2.1.1 Habitat Conservation Plan

The Santa Clara Valley Water District (District) in cooperation with the U.S. Fish and Wildlife Service (FWS), National Marine Fisheries Service (NMFS), and the California Department of Fish and Game (CDFG) has prepared a Multiple Species Habitat Conservation Plan (MSHCP). The MSHCP addresses the District's activities and responsibilities under the federal Endangered Species Act of 1973 as amended (Act) (16 U.S.C 1531-1544). The District, in preparing this MSHCP, is requesting an incidental take statement under Section 10(a) of the Act to conduct flood protection, water supply, and related activities within the District's operational area. The MSHCP addresses projects, activities, and the process the District will use to evaluate the potential for take of covered species. The MSHCP, including the conservation measures, apply only to the District and its activities. Because the District does not regulate land uses in Santa Clara County the MSHCP does not cover other agencies or individuals within Santa Clara County.

2.1.2 Guadalupe Fisheries Management Plan

The expected goal of the District's Guadalupe Fisheries Management Plan is to develop a comprehensive management plan to preserve, protect, and enhance the fishery and aquatic resources of the Guadalupe River and those tributaries capable of supporting or contributing to these resources. The Guadalupe Fisheries Management Plan is in the early preplanning stages. The expected objectives of the plan are to:

- provide guidance for fisheries habitat protection and restoration in the Guadalupe River watershed;
- identify actions the District can take to maintain and improve existing habitat for native fish;

- facilitate communication with stakeholders, including environmental organizations, the public, and regulatory/resource agencies;
- provide a focus for the District's BMPs, program and project coordination, and budgeting for the Guadalupe River watershed;
- provide a coördinated effort to protect and mitigate impacts on fishery resources associated with construction projects, operations, and maintenance tasks;
- encourage innovative solutions for improving aquatic habitat; and
- act as a catalyst for native fish enhancement efforts in South Bay streams.

2.1.3 Downtown Guadalupe River Flood Protection Project (Downtown Project)

Modification and implementation of the remaining components of the Guadalupe River Flood Protection Project (Downtown Project), known as the Segment 3A and 3B reaches, Segment 3C Phase 3 subreach, and the offsite Reach A and Guadalupe Creek mitigation sites, have been proposed recently. These modifications are intended to accomplish the following objectives.

- Provide 100-year flood protection for the downtown San Jose area.
- Protect species recently listed or proposed for listing under the ESA.
- Meet conditions for water quality certification under the federal Clean Water Act (CWA)
- Refine recreational opportunities along the Guadalupe River corridor.
- Implement mitigation commitments specified in the MMP.

Recommended modifications to the Guadalupe River Project include (1) construction and operation of an underground bypass to convey floodwaters around important riparian habitat, (2) expanded onsite and offsite mitigation, and (3) modification of riverfront features to accomplish habitat and recreational goals.

The Segment 3A reach is between Coleman Avenue and New Julian Street. The Segment 3B reach extends from New Julian Street to Park Avenue. The Segment 3C Phase 3 subreach is at the upstream end of the project near I-280. The project would include construction of flood protection features in the Segment 3A and 3B reaches during 2001–2002 and in the Segment 3C Phase 3 subreach during 2002. Installation of riparian vegetation mitigation within Segment 1 began in 1994 and was substantially completed in 1999. Installation of riparian vegetation mitigation within Segment 2 began in 1998 and was substantially completed in 1999. Installation of SRA cover mitigation began in 1999 and will continue through 2002. Installation of anadromous fish habitat mitigation began in 1994 and will continue through 2002.

The Downtown Project previously proposed concrete armoring for most of the riverbank and river bottom in Segments 3A and 3B. That project would have had significant effects on riparian

Table 2-1. Summary of Objectives for Relevant Projects, Programs, and Regulations

Santa Clara Valley Water District Projects and Programs	
Habitat Conservation Plan	■ identify threatened, endangered, and sensitive species found in Santa Clara County; ■ identify threatened, endangered, and sensitive-species habitats in Santa Clara County; ■ identify future District projects and activities that may affect threatened, endangered, and sensitive species; ■ quantify how much of an affect the District has on threatened, endangered, and sensitive species; ■ identify measures to avoid, minimize, and compensate for impacts to threatened, endangered, and sensitive species; ■ develop a District-wide and creek-by-creek habitat conservation plan; ■ reduce conflicts between District activities and federal statutes and regulations; ■ obtain an incidental take statement from the U.S. Fish and Wildlife Service and the National Marine Fisheries Service; and ■ implement the Habitat Conservation Plan.
Guadalupe Fisheries Management Plan	■ provide guidance for fisheries habitat protection and restoration in the Guadalupe River watershed; ■ identify actions the District can potentially take in maintaining and improving existing habitat for native fish; ■ facilitate communication with stakeholders, including environmental organizations, the public, and regulatory/resource agencies; ■ provide a focus for the District internal BMPs, program and project coordination, and budgeting within the Guadalupe River watershed; ■ provide a coordinated effort to protect and mitigate impacts on fishery resources associated with construction projects, operations, and maintenance tasks; ■ encourage innovative solutions for improving aquatic habitat; and ■ act as a catalyst for native fish enhancement efforts in South Bay streams.
Downtown Guadalupe River Flood Control Project	■ provide improved flood protection for downtown San Jose; ■ protect the environmental quality of the Guadalupe River; ■ provide recreational access to the Guadalupe River; ■ avoid impacts and maximize onsite vegetation; ■ maximize onsite revegetation to replace impacted SRA cover vegetation; ■ provide offsite mitigation to replace impacted SRA cover vegetation; ■ provide fisheries mitigation; and ■ provide thermal mitigation.

Table 2-1. Continued

Santa Clara Valley Water District Projects and Programs – Continued	
Upper Guadalupe River Flood Protection Project	■ reduce potential for flood damage along the upper Guadalupe River; ■ improve upstream fish passage for anadromous fish; and ■ maximize onsite revegetation to replace impacted SRA and riparian vegetation.
Lower Guadalupe River Flood Control Project	■ restore channel capacity between Interstate 880 and Alviso UPRR Bridge; ■ avoid or minimize effects on environmental resources within the Guadalupe watershed, including listed species; ■ provide improved flood protection; and ■ define interim operations and maintenance projects to ensure flood management system performance and reliability and to maintain cost-effective flood protection during project implementation.
Stream Maintenance Program	■ standardize and codify practices and protocols for routine sediment removal, stream bank protection, and vegetation management in and around the District's streams and related facilities; ■ identify cost-effective routine stream maintenance practices and protocols; ■ ensure that routine stream maintenance activities reflect the District's policies of environmental protection; ■ establish effective and economically practical compensatory mitigation for significant environmental impacts of routine stream maintenance activities; and ■ establish practices and protocols that optimize operational flexibility.
Regional Projects and Programs	
Santa Clara County General Plan	■ protect and manage natural environmental resources, such as wildlife, vegetation, soils, air, water, and minerals, for their function and ecological values; ■ promote flood control improvements that achieve a desirable balance of resource conservation, flood control, and recreational objectives; ■ maintain and improve water quality through restoration of wetlands, riparian habitats, and other areas; ■ provide for recreation and public trail needs in balance with protecting sensitive resources, such as wetlands and riparian corridors; and ■ preserve and restore natural diversity for its inherent ecological value.

Table 2-1. Continued

Regional Projects and Programs – Continued	
Santa Clara County Countywide Trails Master Plan	■ promote healthy, well-functioning creek, streamside, and Bay wetlands ecosystems that provide: – stable wildlife habitat, corridors that link habitat areas, and protection for endangered species, – passive recreation and interpretive nature study, – aesthetic enhancement of urban and rural settings; ■ restore, where possible, degraded special water environments; and ■ protect the community from flooding.
City of San Jose - San Jose 2020 General Plan	■ preserve, protect, and restore riparian corridors and upland wetlands within the City of San Jose's sphere of influence; ■ preserve habitat suitable for species of special concern, including threatened and endangered species; ■ protect water resources vital to the ecological and economic health of the region and its residents; and ■ protect the community from risk of flood damage.
Santa Clara Basin Watershed Management Initiative	■ preserve, protect, and restore riparian corridors and upland wetlands within the City of San Jose's sphere of influence; ■ preserve habitat suitable for species of concern, including threatened or endangered species; ■ protect the community from the hazards of soil erosion, weak and expansive soils, and overall geologic instability; ■ protect the community from the risk of flood damage; ■ protect water resources because of their importance to the ecological and economic health of the region; and ■ provide park land and recreational areas to preserve significant natural resources and meet the recreational and open-space needs of the community.
Santa Clara County Urban Runoff Pollution Prevention Program	■ provide flood control; ■ reduce the amount of pollutants that enter into waterways to protect the quality of water throughout the watersheds; ■ protect wildlife within the riparian corridor; and ■ protect and restore riparian habitat.

Table 2-1. Continued

Regional Projects and Programs – Continued	
City of San Jose - Riparian Corridor Policy Study	■ reduce pollution entering the waterways from stormwater runoff; and ■ protect and preserve riparian corridors within the Urban Service Area boundary.
City of San Jose - Riparian Restoration Action Plan	■ restore riparian habitat by planting native species, encouraging natural regeneration of native species, and controlling nonnative species; ■ enhance wildlife and fish habitat by restoring the linkage between existing patches of riparian vegetation, restoring the linkage between baylands and the upper watershed, and controlling nonnative species; ■ protect and improve water quality by controlling erosion and sediment deposition; ■ enhance recreational opportunities by incorporating public use and access into restoration plans; ■ enhance public education and outreach opportunities by incorporating environmental education and interpretation into restoration planning, involving local schools and community groups in restoration activities, and coordinating with existing community programs; and ■ maintain or increase flood protection by incorporating measures to improve channel capacity and reduce channel maintenance into restoration planning.
San Francisco Regional Water Quality Control Board's Water Quality Control Plan	■ protect and maintain thriving aquatic ecosystems and the resources those systems provide to society; and ■ accomplish these goals in an economically and socially sound manner.
Fisheries and Aquatic Habitat Collaborative Effort	■ improve habitat conditions to maintain fish populations in good condition; ■ protect, maintain, and improve habitat conditions for species listed under the state and federal Endangered Species Acts or identified as California species of special concern; and ■ improve the availability and suitability of stream corridor and channel habitat for a diversity of fish and wildlife species.

Notes:

The objectives summarized in this table have been simplified from the original text. For the exact wording of each objective, please refer to the original documents.

District = Santa Clara Valley Water District.
SRA = Shaded riverine aquatic.

habitat and SRA cover that would result in adverse thermal impacts to fish habitat. Analyses indicated that no mitigation plan could be developed to mitigate these anticipated thermal impacts. The bypass now proposed would reduce the amount of riparian vegetation and SRA cover affected while still meeting the original goal of providing flood protection to downtown San Jose and vicinity. The proposed bypass also would significantly reduce the need for riverbank and river bottom armoring required. A bypass system was selected as the best method for avoiding or minimizing effects on riparian resources and on federally listed fish and wildlife species. The bypass system would run underground on the east side of the Guadalupe River from the vicinity of West Santa Clara Street to Coleman Avenue.

The environmental commitments of the project include measures to compensate for effects associated with construction, operation, and maintenance. A continuous riverwalk trail system will be developed between Coleman Avenue and Park Avenue. The riverwalk system will be asphalt paved and 12 or 18 feet wide to accommodate both flood protection maintenance use and the estimated 1.3 million annual visitors to the project area.

Construction and mitigation activities associated with the Downtown Project modification would be initiated in the summer of 2000 and be substantially complete by 2002. Some remaining infill planting for habitat restoration, plus long-term operations and maintenance would continue after 2005.

2.1.4 Upper Guadalupe River Flood Protection Project

The Upper Guadalupe River Flood Protection Project (Upper Guadalupe River Project) has been proposed by the District to reduce the potential for flood damage along the upper Guadalupe River. The project includes channel modifications along eight reaches of the upper Guadalupe River. Proposed channel modifications include constructing bypass channels, widening the channel, adding benches, lining portions of the channel bank with gabions and cribwalls, and constructing floodwalls and levees. These modifications are designed to increase the capacity of the Guadalupe River. The project has a total length of approximately 6.4 miles and is divided into two discrete segments: one from Highway 101 to I-880 (Reach A) and another from I-280 to above Blossom Hill Road (Reaches 6 to 12). Modifications also have been proposed on adjacent portions of two tributaries, Canoas Creek and Ross Creek. Construction of the Upper Guadalupe River Project is expected to take place over the 25-year period from 2000 through 2025. Expected flows from a flood protection project in the upper Guadalupe River were included in the modeling of the design floodflow for the Guadalupe River Project with Proposed Action.

The Corps' 1985 Guadalupe River Interim Feasibility Report and EIS (U.S. Army Corps of Engineers, 1985; Section 1.6.1, Guadalupe River Interim Feasibility Report and Environmental Impact Statement [1985]) did not find economic justification for proposed channel modifications upstream from I-280. In the late 1980s, the District initiated an independent planning study for the Upper Guadalupe River Project. Planning and design of the Upper Guadalupe River Project continued concurrent with construction of Segments 1 and 2 of the Downtown Project. In 1997, the

District and the Regulatory Branch of the Corps, San Francisco District, prepared a draft EIR/EIS for the Upper Guadalupe River Project (Santa Clara Valley Water District and U.S. Army Corps of Engineers, 1997).

The Upper Guadalupe River Project, as presently proposed, will affect approximately 10.45 acres of riparian vegetation, 4,886 lf of SRA cover vegetation, and 1.47 acres of wetlands. Other impacts of the Upper Guadalupe River Project include short-term elevations in stream water temperatures and a net decrease in the amount of in-channel armoring. Informal consultation with USFWS on this project was completed in 1997. No adverse impacts on listed terrestrial vertebrates or plants were identified.

Proposed channel modifications would result in beneficial impacts on stream ecology, hydrology, and fisheries. These include permanently fixing the concrete apron and weir at Hillsdale Avenue (Reach 10C) and a low-flow vehicle-crossing downstream from Ross Creek (Reach 11B) to provide improved passage for fish (interim fixes were completed in November 1998). Both structures are potential barriers to upstream migration by adult salmon and steelhead. Only during peak urban storm runoff or prolonged watershed runoff are flows high enough to allow successful fish passage. Permanently fixing the interim structures would improve access for migrating fish from San Francisco Bay upstream to the drop structure above Blossom Hill Road. The District would also move Stream Gage Station No. 23B, a partial barrier to fish migration, from its location in the vicinity of Pearl Avenue Bridge downstream to the vicinity of the northbound Almaden Expressway bridge (Reach 10B). The new stream gage will be constructed so that it will not be a barrier to fish migration. Stepped pools would be constructed at the Ross Creek confluence and at the Alamitos drop structure upstream from Blossom Hill Road. The District would also improve fish passage conditions on Guadalupe Creek at Stream Gage Station No. 43 and at a concrete channel stream reach midway between the confluence of Pheasant Creek with Guadalupe Creek and Reynolds Road to provide access for migrating fish to an additional 1.3 miles of stream habitat upstream from Masson Dam. In addition, the District proposes to provide for fish passage at the gabion structure on Alamitos Creek upstream from Mazzone Drive and at Stream Gage Station No. 16 on Alamitos Creek. These improvements would provide access for migratory fish to approximately 10.9 miles of upstream fish habitat. Vortex rock weirs would be constructed between Willow Glen Way and Branham Lane (Reaches 9, 10, and 11) to provide instream cover and deepen the feeding areas for fish in the riffle reach of the channel. The weirs would act as a grade-control structure and prevent upstream lateral migration, bank erosion, and aggradation. They would also maintain a low width-to-depth ratio, which would reduce the likelihood of sand or gravel bar deposition and maintain the sediment transport capacity of the stream. The project would remove approximately 5,930 lf (134,400 sf) of rubble in the construction area. Approximately 3,375 lf (0.6 bank mile; 84,300 sf) would become natural bank. The Upper Guadalupe River Project is also expected to reduce the frequency and quantity of bank erosion, thereby improving water quality. The proposed riparian mitigation also would provide a more continuous riparian corridor along the upper Guadalupe River by reducing the number and lengths of gaps in riparian vegetation.

2.1.5 Lower Guadalupe River Flood Protection Project

The proposed Lower Guadalupe River Flood Protection Project (Lower Guadalupe River Project) includes flood protection measures on the Guadalupe River between I-880 and the Alviso UPRR Bridge and downstream from the Alviso UPRR Bridge in Alviso Slough. The entire length of this project has earthen levees on both banks.

In 1985, during the planning and design of the Guadalupe River Project, it was understood, based on the best available information, that the lower Guadalupe River had adequate capacity to safely convey the 100-year design floodflow of 17,000 cfs (U.S. Army Corps of Engineers, 1985). No adverse impacts on lower Guadalupe River hydrologic or hydraulic conditions were expected as a result of the Guadalupe River Project. In a 1991 agreement with the Corps, the District certified that the lower Guadalupe River had the capacity to safely convey the 100-year design floodflow.

After the January and March 1995 storm events on the Guadalupe River, the District initiated studies to reassess the conveyance capacity of the lower Guadalupe River. In 1998, the District completed the analysis and concluded that the lower Guadalupe River below I-880 does not have sufficient capacity to convey the 100-year design floodflow of 17,000 cfs. From Trimble Road downstream to the town of Alviso, channel capacity has been reduced by approximately 40%, primarily because of sediment deposition. In addition, the hydraulic modeling of the lower Guadalupe River used in the analysis assumed that vegetation in the river is mature, which results in an increase in channel roughness. This assumption decreased the modeled capacity of the lower Guadalupe River.

The District is developing the Lower Guadalupe River Project to restore the channel capacity between I-880 and the Alviso Union Pacific Railroad (UPRR) Bridge and to identify alternatives for conveying floodflows downstream from the Alviso UPRR Bridge. The Lower Guadalupe River Project would be implemented by the District to restore the channel capacity guaranteed in the District's 1991 agreement with the Corps. The Lower Guadalupe River Project will provide channel capacity to convey flows from the Guadalupe River Project with Proposed Action and the Upper Guadalupe River Project.

In 1998, the Corps, the District, and the resource agencies (USFWS, NMFS, DFG, and the San Francisco Bay RWQCB) agreed through a collaborative process to modify the Guadalupe River Project by using a bypass to avoid impacts on environmental resources. The collaborative discussed whether it was appropriate to proceed with the Guadalupe River Project in light of the new information on the decreased capacity of the lower Guadalupe River. The resource agencies allowed the Guadalupe River Project to remain a separate project on schedule for completion in 2002. Completion of the Lower Guadalupe River Project also is scheduled for 2002.

The Lower Guadalupe River Project EIR/EIS will address a full range of alternatives for flood protection downstream from I-880 and for conveying floodflows downstream from Alviso. The alternatives will be designed to contain the increased flows that would result from the operation of the Guadalupe River Project with Proposed Action and the Upper Guadalupe River Project and to minimize or avoid impacts on environmental resources in the Guadalupe River watershed, including listed species and their habitat. Flood protection elements could include raising existing levees, setting levees farther back from the river, constructing offstream storage, constructing flood bypasses, dredging the channel, or a combination of some or all of these elements. The Lower Guadalupe River Project EIR/EIS will address the potential direct, indirect, and cumulative impacts of each alternative on natural resources in the Guadalupe River watershed, including the Alviso Slough area. The District will consult with USFWS's Endangered Species Division regarding the potential hydrologic and hydraulic impacts of the Lower Guadalupe River Project. If an impact is identified, appropriate mitigation measures will be included in the EIR/EIS and BA for the Lower Guadalupe River Project, and the District will prepare an MMP for the Lower Guadalupe River Project for review and approval by the Endangered Species Division.

The EIR/EIS and BA for the Lower Guadalupe River Project will also address the cumulative impacts of all projects in the Guadalupe River watershed that would affect the river's resources. The analysis of cumulative impacts will include, but not be limited to, the Guadalupe River Project with Proposed Action, the Upper Guadalupe River Project, and the Lower Guadalupe River Project. Construction of the Upper Guadalupe River Project and the Guadalupe River Project with Proposed Action would not foreclose or limit options to develop appropriate mitigation for cumulative impacts determined in the Lower Guadalupe River Project EIR/EIS.

The Lower Guadalupe River Project EIR/EIS will identify alternatives and evaluate the potential impacts of each alternative. To estimate potential impacts of the Lower Guadalupe River Project for this cumulative impact analysis, two alternatives for the Lower Guadalupe River Project that encompass the potential range of impacts of the project have been considered. One alternative would restore the original design capacity by removing sediment from the entire channel between Highway 101 and the Alviso UPRR Bridge. This alternative focuses on instream modifications and represents an alternative at the upper range of expected impacts. This alternative could result in the temporary removal of approximately 65 acres of wetlands and affect an estimated 30 acres of other waters of the United States. An estimated 2.5 acres of riparian habitat, including SRA cover vegetation, could be removed, primarily downstream from Montague Expressway. Most of the temporary impacts on wetlands would be self-mitigating because the wetlands would be likely to reestablish. However, the types of species in the wetlands and their distribution may be different. It may also take several seasons for wetlands to reestablish throughout the channel. The significance of this change has not been evaluated nor have all potential mitigation options. However, impacts on riparian habitat will be mitigated.

An alternative at the lower range of expected impacts would avoid instream work. Such an alternative could include flood bypasses, raising levees, setting back levees, constructing offstream storage, and combinations of these techniques. This alternative would avoid impacts on wetlands and SRA cover vegetation and minimize impacts on riparian habitat, aquatic resources, water quality, and aesthetic resources. It is likely that the selected project alternative ultimately will be a combination of many options, such as instream and out-of-channel structural modifications and modifications to operations and maintenance practices. Between the Alviso UPRR Bridge and the confluence of Alviso Slough with Coyote Creek and San Francisco Bay, potential modifications include raising existing levees, building new floodwalls, setting levees farther back from the slough, establishing a floodplain terrace, and combinations of these alternatives.

This cumulative impact analysis assumes that a combination of instream and out-of-channel structural modifications will be implemented between Highway 101 and the Alviso UPRR Bridge as part of the Lower Guadalupe River Project. The analysis also assumes that a combination of floodwalls/levees and a floodplain terrace will be implemented downstream from the Alviso UPRR Bridge in the Alviso Slough area.

The lower Guadalupe River between the I-880 bridge and the Highway 101 bridge has a channel capacity of approximately 17,000 cfs. Between the Highway 101 bridge and the Highway 237 bridge, the channel capacity is limited to approximately 14,000 cfs. The channel capacity between the Highway 101 bridge and the Highway 237 bridge serves to limit the peak floodflows that can be conveyed in the lower Guadalupe River. Under existing conditions, flows greater than 14,000 cfs break out of the channel along the lower Guadalupe River upstream from the Highway 237 bridge. Downstream from the Highway 237 bridge, floodflows in the Guadalupe River are limited to 14,000 cfs. Floodflows overtop the west levee into adjacent salt evaporation ponds just downstream from the Alviso UPRR Bridge. When flows reach 14,000 cfs at the Alviso UPRR Bridge, approximately 5,500 cfs flow into the salt evaporation ponds. Floodflows are limited to approximately 8,500 cfs in Alviso Slough. The existing channel capacity of the lower Guadalupe River at the Highway 237 bridge will remain at approximately 14,000 cfs until the Lower Guadalupe River Project has been completed. In addition, the lower Guadalupe River/Alviso Slough area will not experience a change in floodflow frequency, duration, or magnitude from existing conditions because the channel capacities in the lower Guadalupe River/Alviso Slough area will remain the same until the Lower Guadalupe River Project has been completed. With completion of the Lower Guadalupe River Project, the flows at the Highway 237 bridge during the 100-year design flood event would be expected to range from 17,000 to 20,000 cfs, depending on the amount of floodwater pumped into the lower Guadalupe River from adjacent storm drains.

Because of the reduced capacity of the lower Guadalupe River, the potential for flooding between I-880 and the Alviso UPRR Bridge would increase if the Guadalupe River Project with Proposed Action were to be operated without the flood protection provided by a flood protection project in the lower Guadalupe River. Therefore, the entire Guadalupe River Project with Proposed Action would not be made operational until the Lower Guadalupe River Project has been completed. Until the Lower Guadalupe River Project is operational, all bypasses will remain closed with bulkheads and the flood training walls in Segment 3C will remain unfinished. Therefore, any potential cumulative effects of the Guadalupe River Project with Proposed Action will not occur until the Lower Guadalupe River Project is operational.

2.1.6 Stream Maintenance Program

2.1.6.1 Santa Clara Valley Water District Maintenance Program

SCVWD is currently considering implementing the SCVWD Maintenance Program (Maintenance Program) and is preparing a Maintenance Program EIR to address potential impacts. The EIR will address the impacts of sediment removal, erosion protection, vegetation control, and other program elements on a program level. Alternative methods of accomplishing the work and BMPs will be presented. Any residual impacts that remain after BMPs are implemented will be identified and mitigated. It is unknown what impacts the Maintenance Program will have on Guadalupe Creek because the details of the program have not yet been defined.

2.1.6.2 Total Maximum Daily Load Program

The CWA includes a number of provisions and specifies a variety of programs aimed at improving and maintaining national water quality. Section 303(d) of the CWA requires States to prepare a list of waters within the State that do not currently meet water quality standards. Section 303(d) also requires preparation of Total Maximum Daily Load's (TMDL) for those waters identified by the State as impaired, where traditional local controls have not resulted in full compliance with the standards. A TMDL is a quantitative assessment of a water quality problem. This can include a pollutant, such as heavy metals or pesticide, or a physical property of the water, such as dissolved oxygen or temperature. A TMDL qualitatively establishes the amount of pollutant in a water body and specifies an allowable load of the pollutant from individual sources that assure water quality standard compliance and beneficial use protection.

Several waterways within the Guadalupe River watershed including Guadalupe Creek and Guadalupe River have been listed on the State's Section 303(d) list of impaired waters. Impairment of water contact recreation (REC-1) beneficial uses through unsafe levels of mercury present in the tissues of sport fish constitutes a violation of the San Francisco Bay RWQCB's narrative water quality objective for bioaccumulation of toxic contaminants. In response, the San Francisco Bay RWQCB has prepared a work plan for Guadalupe River watershed mercury TMDL preparation, with a final TMDL and implementation plan scheduled for completion in 2003/2004.

2.2 OTHER REGIONAL EFFORTS

2.2.1 Santa Clara County General Plan

The Santa Clara County General Plan was adopted in 1994. Its purpose is to provide the county with comprehensive countywide direction for growth and development from 1995 to 2010.

The aims of the plan are expressed through a series of goals that can be classified under four basic themes:

- social and economic well-being;
- managed, balanced growth;
- livable communities; and
- responsible resource conservation.

Technically, the County General Plan is not legally binding for cities under County jurisdiction, many of which, including San José, have separate city-level general plans. However, the County General Plan encourages the voluntary support of Santa Clara County municipalities to achieve its countywide goals.

2.2.2 Santa Clara County Countywide Trails Master Plan Update

The Santa Clara County Countywide Trails Master Plan Update summarizes the County's trails-planning history and presents a master plan for a countywide trail network. The plan was developed by the Santa Clara County Trails Master Plan Advisory Committee and was adopted by the Santa Clara County Board of Supervisors on November 14, 1995. The countywide trail network proposed in the Trails Master Plan Update comprises 535 miles of off-street trails (105 miles of existing trails and 430 miles of proposed trails) and an additional 120 miles of on-street bicycle-only routes (Santa Clara County 1995). The proposed trail system traverses both public and private lands. To guide implementation of the trail system plan, the Trails Master Plan Update suggests procedures for coordinating with private landowners, establishing trail segment priorities, mitigating environmental impacts, and specifying details of trail design, operations, and management. Construction of the proposed trail system is expected to take place over several decades.

2.2.3 City of San Jose 2020 General Plan

The City of San Jose's 2020 General Plan was adopted in 1994 as a comprehensive 25-year plan for the City's Sphere of Influence. It represents the City's assessment of the amount, type, and phasing of development needed to achieve specific social, economic, and development objectives (City of San Jose 1994). Seven major strategies, each defined by specific goals and supported by specific policies, encompass the principal objectives of the General Plan. Of these, both the Greenline Major Strategy and the Sustainable City Major Strategy are vital to the preservation of natural habitat and a healthy living environment in the City.

2.2.4 Santa Clara Basin Watershed Management Initiative

The Santa Clara Basin Water Management Initiative (WMI) was begun in 1996, with a stated mission of "protecting and enhancing the watershed, [and] creating a sustainable future for the community and the environment." WMI was conceived by the EPA, the State Water Resources Control Board, the Water District, and the San Francisco Bay Regional Water Quality Control Board. The WMI addresses all sources of pollution threatening San Francisco Bay, in order to safeguard water quality throughout the Santa Clara Basin watershed. The central aim of WMI is to coordinate existing regulatory activities on a basinwide scale, rather than to establish separate regulatory actions for specific issues. Because of its regional scope, WMI involves the coordination of numerous stakeholders representing a cross section of the Santa Clara Basin business, agricultural, residential, environmental and regulatory communities. A major milestone of WMI will be the development and approval of a regional watershed management plan.

2.2.5 Santa Clara Valley Urban Runoff Pollution Prevention Program

Fifteen Santa Clara County entities participate in the Santa Clara Valley Urban Runoff Pollution Prevention Program, including the City of San Jose and 12 other local municipalities, the County of Santa Clara, and the Water District. These agencies are co-permittees under a National Pollutant Discharge Elimination System stormwater permit issued by the RWQCB. As a condition of the permit, the participant agencies created an Urban Runoff Management Plan, which identifies the activities various City departments are required to undertake in order to comply with the federal and state requirements of the stormwater permit.

2.2.6 City of San Jose – Riparian Corridor Policy Study

The Riparian Corridor Policy Study (RCPS) was commissioned by the City of San Jose in 1992 in response to the City's recognition of the biological, recreational, aesthetic, and economic importance of its remaining riparian corridors. The intent of the study was to examine in detail issues related to, and methods for promoting, the preservation of riparian corridors. The RCPS focuses on riparian corridors within the Urban Service Area, on the assumption that corridors outside the Urban Service Area are more widely protected by the County's General Plan. Results of the study were approved in 1994, and underwent revisions in 1999 (City of San Jose 1994). Baseline inventories and policy guidelines from this study provide the City with information necessary to maintain and enhance existing riparian habitats in areas slated for future development. The RCPS includes provisions for a 100-foot setback from streams, as well as other measures designed to minimize the impact of new construction on remaining riparian corridors in the City's Urban Service Area.

2.2.7 City of San Jose – Riparian Restoration Action Plan

The City of San Jose Riparian Restoration Action Plan (RRAP) is a guide for correcting and reversing past damages to streams and corridors within San Jose's Urban service Area. The RRAP area includes 136 miles of streams within the Guadalupe River, San Tomas Aquinas/Saratoga Creek, and Calabazas Creek Watersheds. The primary goals of the RRAP include restoration of riparian habitat by planting locally native species, enhancement of wildlife and fish habitat by restoring connectivity between habitat zones withing the watershed and bay, and the protection and improvement of water quality by controlling erosion and sediment deposition.

The RRAP outlines key technical restoration opportunities and constraints within the planning area. These include opportunities and constraints as it relates to adjacent land use, flood protection, erosion and sedimentation, vegetation and wildlife habitat, and exotic species removal and control. Restoration strategies included in the plan fall under broad categories of technical, education and outreach, and legal strategies. These strategies are designed to be incorporated into a site-specific restoration plan. The Guadalupe Creek restoration plan includes many of the technical strategies found in the RRAP, including the creation of meanders, creating instream cover, removing hardscape, and the use of tree revetments.

The RRAP also provides guidelines for the implementation of restoration strategies. These guidelines include the selection of the project planning and design team, site preparation, plant selection, irrigation, environmental compliance, monitoring, and maintenance.

2.2.8 San Francisco Bay Regional Water Quality Control Board and State Water Resources Control Board Water Quality Control Plan

SWRCB and RWQCB for the San Francisco Bay Region establish policies and procedures that are designed to ensure the protection of surface water and groundwater from degradation. The RWQCB establishes beneficial uses of surface water and groundwater resources, along with narrative and numerical water-quality objectives to protect those uses, in its Water Quality Control Plan for the San Francisco Bay Basin (California Regional Water Quality Control Board, 1995). The RWQCB administers the NPDES permitting and Section 401 water quality certification Processes.

Under the authority of Section 303(d) of the CWA, RWQCB and SWRCB list water bodies as impaired when not in compliance with designated water-quality objectives and standards. Section 303(d) also requires preparation of a Total Maximum Daily Load (TMDL) program for waters identified by the State as impaired. A TMDL is a quantitative assessment of a problem that affects water quality. The problem can include the presence of a pollutant, such as a heavy metal or a pesticide, or a change in a physical property of the water, such as a water body and specifies an allowable load of the pollutant from individual sources to ensure compliance with water quality standards. Once the allowable load and existing source loads have been determined, reductions in allowable loads are allocated to the individual sources.

2.2.9 Fisheries and Aquatic Habitat Collaborative Effort (FAHCE)

The Guadalupe River, Coyote Creek, and Stevens Creek provide habitat for a variety of aquatic resources, including fall-run chinook salmon and steelhead. Many activities, including water management, urban encroachment, land uses, agricultural use, reclamation, flood protection, and water supply operations by the District, cause concern for the condition of the public trust resources and the quality and availability of instream habitat in the river and creeks. These activities also raise concern about the economic and social impacts of efforts to significantly alter the existing flow regimes of the river and creeks. The District has been named in a complaint filed before the SWRCB for violations of the California Fish and Game Code, the California Water Code, and Public Trust Doctrine related to the District's incremental contribution to the cumulative impacts on chinook salmon and steelhead and their habitat within the river and creeks. The complaint alleges harm to coldwater fisheries as a result of consumptive urban and agricultural water uses in Santa Clara County. To address this complaint, the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) has been initiated jointly by the District and DFG.

The FAHCE will identify factors limiting steelhead and chinook salmon populations in the Guadalupe River, Coyote Creek, and Stevens Creek watersheds. Both flow and nonflow measures will be considered by the FAHCE when addressing the complaint. Participants include the District; DFG; Guadalupe-Coyote Resource Conservation District, Pacific Coast Federation of Fishermen's Associations, and Trout Unlimited, as represented by NHI; NMFS; USFWS; and the City. The FAHCE study is expected to be completed in 2001.

2.3 STATE REGULATIONS

2.3.1 California Environmental Quality Act

CEQA (Public Resource Code 21000 et seq.) provides the foundation for environmental law and policy in California. The primary objectives of CEQA are:

- to disclose to decision makers and the public the significant environmental effects of proposed projects;
- to identify ways to avoid or reduce environmental damage;
- to prevent environmental damage by requiring implementation of feasible project alternatives and/or mitigation measures;
- to disclose to the public reasons for agency approval of projects with significant environmental impacts;

- to foster interagency coordination in the review of projects; and
- to enhance public participation in the planning and environmental review process.

CEQA applies to all discretionary activities proposed, implemented, or approved by California public agencies, including state, regional, county, and local agencies, unless a specific exemption applies.

CEQA requires that public agencies comply with both procedural and substantive requirements. Procedural requirements under CEQA include the preparation of appropriate environmental documents, consideration of project alternatives, development of mitigation measures and a mitigation monitoring program. CEQA also specifically provides for public involvement in the review process by requiring public notice of preparation of environmental documents, establishing a public scoping process, and requiring lead agencies to respond to public comments in final environmental documents. CEQA's substantive provisions require agencies to address environmental impacts disclosed in an appropriate document. When avoiding or minimizing environmental damage is not feasible, CEQA requires agencies to prepare a written statement of overriding considerations when they decide to approve a project that will cause one or more significant effects on the environment. CEQA also establishes a series of action-forcing procedures to ensure that agencies accomplish the purposes of the law. In addition, under the direction of CEQA, the California Resources Agency has adopted regulations, known as the state CEQA Guidelines, which provide detailed procedures that agencies must follow to implement the law.

This EIR/EIS was prepared to comply with the requirements of CEQA and the CEQA Guidelines.

2.3.2 California Fish and Game Code, Sections 1601–1607 (Lake or Streambed Alteration Agreement Program)

Under Sections 1601–1607 of the California Fish and Game Code, the California Department of Fish and Game (DFG) regulates projects that affect the flow, channel, or banks of natural bodies of water. Project proponents are required to notify and enter into a streambed alteration agreement with DFG before beginning construction of a project that will: (1) divert, obstruct, or change the natural flow or the bed, channel, or bank of any river, stream, or lake; (2) use materials from a streambed; or (3) result in the disposal or deposition of debris, waste, or other material containing crumbled, flaked, or ground pavement where it can pass into any river, stream, or lake. Sections 1601–1607 typically do not apply to drainages that lack a defined bed and banks, such as swales and vernal pools.

The District has submitted a Section 1601 application to DFG for a Lake or Streambed Alteration agreement. It is anticipated that the District will receive an agreement from DFG in May 2001.

2.3.3 California Endangered Species Act and Implementing Regulations

The California Endangered Species Act (CESA) protects wildlife and plants listed as threatened and endangered by the California Fish and Game Commission. It is administered by DFG. CESA requires state agencies to seek and conserve threatened and endangered species and thus restricts all persons from taking listed species except under certain circumstances; *take* is defined as any action or attempt to "hunt, pursue, catch, capture, or kill." Section 2080 of the California Fish and Game Code prohibits the take of species listed as threatened or endangered by DFG. However, under Section 2081, DFG may issue incidental take permits for species that are not designated as "fully protected." The requirements for an application for an incidental take permit are described in Section 2081 and in final adopted regulations for implementing Sections 2080 and 2081.

2.3.4 California Air Quality Regulations

State air quality regulations are the responsibility of the California Air Resources Board (CARB), an arm of the California Environmental Protection Agency (Cal-EPA). The California Clean Air Act of 1988 established California ambient air quality standards (CAAQS), which, unlike the federal NAAQS standards, represent concentrations that should never be exceeded. Under the California Clean Air Act, attainment of air quality within the state's individual "air basins" (defined on the basis of topography and air circulation patterns) is the responsibility of local Air Quality Management Districts. The Air Quality Management Districts are required to develop plans and strategies for attaining CAAQS. Santa Clara Valley, including the proposed project site, is located in the southern portion of the San Francisco Bay Area Air Basin (SFBAAB) and is under the jurisdiction of the Bay Area Air Quality Management District (BAAQMD).

2.3.5 California Hazardous Materials Regulations

Various state regulations govern hazardous materials and hazardous waste management. State hazardous waste regulations are primarily contained in the California Code of Regulations (CCR), Title 22, Division 4, Environmental Health. Of particular relevance to the proposed project are 22 CCR §66261.20 and §66261.24, which establish the threshold limit for total mercury content at 20 mg/kg; material is considered hazardous if its mercury content exceeds this threshold. In addition, the Hazardous Waste Control Law lists hundreds of hazardous and potentially hazardous chemicals, establishes criteria for identifying hazardous materials, regulates the storage, transport, and disposal of hazardous wastes, and identifies hazardous wastes that cannot be disposed of on land. In addition, water quality regulations developed from the Porter-Cologne Water Quality Control Act (see following section) are designed to protect the quality of waters in California; CCR Title 23 contains the water quality regulations pertinent to environmental contamination. In the San Jose area, these state regulations are administered by the RWQCB and the District.

2.3.6 Porter-Cologne Water Quality Control Act

Under the Porter-Cologne Water Quality Control Act of 1975, beneficial uses of California's major rivers and groundwater basins, along with narrative and numerical water quality objectives, are established and periodically reviewed in Water Quality Control Plans (basin plans) (California Regional Water Quality Control Board 1995). CWA assigns the primary responsibility for protecting surface- and groundwater resources from degradation, including oversight of basin plans, to the Regional Water Quality Control Boards. Basin plans are primarily implemented by using the NPDES permitting system to regulate waste discharges.

The RWQCB has not formally designated beneficial uses for Guadalupe Creek. Consequently, water quality in Guadalupe Creek must meet or exceed the necessary requirements for maintaining the beneficial uses of the Guadalupe River. Existing uses of the Guadalupe River include non-contact recreation, and warmwater fish and wildlife habitat; potential uses include contact recreation and migration and spawning of anadromous fish.

2.4 FEDERAL REGULATIONS

2.4.1 National Environmental Policy Act

The National Environmental Policy Act (42 United States Code [USC] 4321; 40 Code of Federal Regulations [CFR] 1500.1) is the nation's broadest environmental law. NEPA provides an interdisciplinary framework for federal agencies to prevent environmental damage, and contains action-forcing procedures to ensure that federal agency decision makers take environmental factors into account. NEPA applies to all federal agencies and to most of the activities they manage, regulate, or fund that affect the environment. It requires all agencies to consider and to publicly disclose the environmental implications of their proposed actions through the preparation of appropriate documents. The President's Council on Environmental Quality (CEQ) has adopted regulations and other guidance providing detailed procedures that federal agencies must follow to implement NEPA.

This EIR/EIS was prepared to comply with the requirements of NEPA and relevant implementing regulations.

2.4.2 Endangered Species Act, Sections 7, 9, and 10

The USFWS has jurisdiction over species listed as threatened or endangered under Section 9 of the Endangered Species Act (ESA). The ESA protects listed species from harm, or *take*. *Take* is broadly defined as "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to engage in any such conduct."

ESA Section 7 requires federal agencies to consult with the Secretary of the Interior through the U.S. Fish and Wildlife Service (USFWS) and the Secretary of Commerce through NMFS to ensure that agency projects do not jeopardize the continued existence of endangered or threatened species or destroy or adversely modify critical habitat that supports such species. If a proposed project "may affect" a listed species or designated critical habitat, the lead agency must prepare a biological assessment (BA) to determine whether the effect is "adverse." If the effect is determined to be adverse, USFWS and/or NMFS must prepare a biological opinion. If the project does not jeopardize the continued existence of the species, USFWS may issue an incidental take permit under ESA Section 10, which requires the lead to submit a conservation plan addressing project impacts and mitigation measures.

Two federally listed species are known to occur in the project area: steelhead (federally listed as threatened) and chinook salmon (federal candidate species). Moreover, as part of the Central California Coast evolutionarily significant unit (ESU) for steelhead, the segment of Guadalupe Creek downstream of Guadalupe Reservoir has been designated by NMFS as critical habitat for steelhead. Because the proposed project will require the issuance of a permit by the U.S. Army Corps of Engineers, San Francisco District, under Section 404 of the Clean Water Act (CWA; see additional discussion in following paragraphs), the project is considered a federal undertaking and the Corps must comply with Section 7 of the ESA. Accordingly, consultation with NMFS has begun. The potential cost-sharing relationship between the Corps and the District also necessitates Section 7 consultation between the Corps and NMFS.

2.4.3 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) establishes a management system for national marine and estuarine fishery resources. This legislation requires all Federal agencies to consult with the National Marine Fisheries Service (NMFS) regarding all actions or proposed actions permitted, funded, or undertaken that may adversely affect "essential fish habitat" (EFH). EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The legislation states that migratory routes to and from anadromous fish spawning grounds should also be considered EFH. The phrase *adversely affect* refers to any impact that reduces the quality or quantity of EFH. Federal activities that occur outside an area designated as EFH but that may, nonetheless, have an impact on EFH waters and substrate must also be considered in the consultation process. In addition, the Magnuson-Stevens Act requires that consultation consider effects on habitat managed under the Pacific Salmon Fishery Management Plan. The Magnuson-Stevens Act states that consultation regarding EFH should be consolidated, where appropriate, with the interagency consultation, coordination, and environmental review procedures required by other federal statutes. In most cases, the environmental compliance required for federal activities will satisfy consultation requirements under the Magnuson-Stevens Act. EFH consultation requirements can be satisfied through concurrent environmental compliance if the lead agency provides NMFS with timely notification of actions that may adversely affect EFH and if the notification meets requirements for EFH assessments.

The Downtown Project identified the Guadalupe Creek Restoration Project site as a likely offsite mitigation area for impacts of the Downtown Project on SRA habitat. A general description of the proposed project is thus included in the project description for the Downtown Project, and the proposed project's SRA cover elements were included in environmental compliance for the Downtown Project. Based on a finding by NMFS, the Downtown Project's compliance with the Endangered Species Act (see following section) will suffice as the EFH assessment required by the Magnuson-Stevens Act (U.S. Army Corps of Engineers and Santa Clara Valley Water District 2000).

2.4.4 Clean Water Act

2.4.4.1 Section 303(d)

Under CWA Section 303(d), the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards are required to list bodies of water as impaired when the traditional permitting processes for waste discharges have failed to maintain designated water quality objectives and standards. CWA Section 303(d) also requires preparation of a Total Maximum Daily Load (TMDL) program for waters identified by the state as impaired. A TMDL is a quantitative assessment of a problem that affects water quality. A TMDL specifies the allowable load of pollutants from individual sources to ensure compliance with water quality standards. Once the allowable load and existing source loads have been determined, reductions in allowable loads are allocated to the individual pollutant sources.

Parts of the Guadalupe River system (including Guadalupe Creek, Guadalupe Reservoir, Alamitos Creek, and Calero Reservoir) and the southern part of San Francisco Bay are considered impaired for mercury under CWA Section 303(d), meaning that they contain mercury in unacceptable concentrations. The project area is under the jurisdiction of the San Francisco Bay Regional Water Quality Control Board (hereafter, RWQCB), which has prepared a draft TMDL program for mercury for San Francisco Bay. The program calls for a significant reduction in the transport of mercury to the Bay by the Guadalupe River system, and establishes a goal of reducing the concentration of mercury in sediments to less than 0.4 mg/kg total mercury relative to the percentage of material less than 63 micrometers (μm) in diameter.

2.4.4.2 Section 404 and 230

Under CWA Section 404, the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (EPA) regulate the discharge of dredged and fill materials into "waters of the United States." *Waters of the United States* include lakes, rivers, streams and their tributaries, as well as wetlands. Wetlands are defined for regulatory purposes as areas "inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR 328.3, 40 CFR 230.3). Project proponents must obtain a permit from the Corps for all discharges of dredged or fill material into waters of the United States, including wetlands, before proceeding with a proposed action. The U.S. Army Corps of Engineers may either issue individual permits on a case-by-case basis or general permits on a program level.

Discharges to waters of the United States are further regulated under CWA Section 230. Under CWA Section 230.10(a), Section 404 and other permits may be issued only for the "least environmentally damaging" alternative. That is, a proposed discharge may not be permitted if there is a practicable alternative that would have less adverse impacts and lacks other significant adverse consequences.

For regulatory purposes, the project area is under the jurisdiction of the U.S. Army Corps of Engineers, San Francisco District. The District and the Corps have applied for a Section 404 permit for the proposed project.

2.4.4.3 Section 402

CWA Section 402 regulates construction-related stormwater discharges to surface waters through the National Pollutant Discharge Elimination System (NPDES) program, administered by the EPA. In California, the SWRCB is authorized by the EPA to oversee the NPDES program through the Regional Water Quality Control Boards.

NPDES permits are required for projects that disturb more than 5 acres of land. The NPDES permitting process requires the applicant to file a public notice of intent to discharge stormwater and to prepare and implement a Storm Water Pollution Prevention Plan (SWPPP, pronounced "swip"). The SWPPP includes a site map and a description of proposed construction activities. In addition, it describes the best management practices that will be implemented to prevent soil erosion and discharge of other construction-related pollutants (e.g., petroleum products, solvents, paints, cement) that could contaminate nearby water resources. Permittees are required to conduct annual monitoring and reporting to ensure that best management practices are correctly implemented and effective in controlling the discharge of stormwater-related pollutants.

The District will submit a notice of intent to discharge stormwater to the SWRCB. The contractor selected by the District to construct the proposed project will be required to prepare and implement a SWPPP and a monitoring program.

2.4.4.4 Section 401

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in a discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate, or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval, such as issuance of a Section 404 permit) must also comply with CWA Section 401.

The District has submitted a written request to the RWQCB for water quality certification, to comply with CWA Section 401. The RWQCB is expected to issue a Section 401 water quality certification for the proposed project in May 2001.

2.4.5 Clean Air Act

The Clean Air Act (CAA) of 1970 established national ambient air quality standards (NAAQS) for six pollutants: carbon monoxide (CO), ozone, particulate matter with a diameter less than 10 microns (inhalable particulate matter, PM10), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead. Most standards were set to protect public health; however, for some pollutants, standards are based on other values, such as protection of crops, protection of materials, and avoidance of nuisance conditions. Except for ozone, NAAQS represent short-term (24 hours or less) concentrations that may be exceeded no more than once per year and annual concentrations that may never be exceeded. NAAQS for ozone may be exceeded no more than 3 days in 3 years.

Areas that fail to meet NAAQS are called nonattainment areas. The CAA requires states to submit a state implementation plan (SIP) for nonattainment areas. The SIP, which is reviewed and approved by EPA, must delineate proposed methods for attaining NAAQS. States that fail to submit a plan or to secure approval may be denied federal funding and/or required to increase emission offsets for industrial expansion. The 1990 Amendments to the CAA established categories of air pollution severity for nonattainment areas, ranging from "marginal" to "extreme." SIP requirements vary, depending on the degree of pollution severity.

CAA's conformity provisions are designed to ensure that federal agencies contribute to efforts to achieve the NAAQS. EPA has issued two regulations implementing these provisions. The general conformity regulation addresses actions of federal agencies other than the Federal Highway Administration and the Federal Transit Administration. General conformity applies to a wide range of actions or approvals by federal agencies. Projects are subject to general conformity if they exceed emissions thresholds set in the rule and are not specifically exempted by the regulation. Such projects are required to fully offset or mitigate project-related emissions, including both direct emissions and indirect emissions over which the federal agency has some control.

2.4.6 National Historic Preservation Act, Section 106

Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, requires federal agencies or agencies for which they provide funding or issue permits to take into account the effects of their actions on cultural resources listed in, or eligible for listing in, the National Register of Historic Places (NRHP) and to afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on these actions.

The proposed project will require the issuance of a permit by the U.S. Army Corps of Engineers, San Francisco District, under Section 404 of the CWA; therefore, the project is considered a federal undertaking. As a result, the Corps must comply with Section 106 of NHPA. Consultation with the State Historic Preservation Officer (SHPO) was completed in July 2000; SHPO concurred with the determination that no historic properties will be affected by implementation of the proposed project (Abeyta pers. comm.).

2.4.7 Executive Order 11990, Protection of Wetlands

Executive Order 11990 (May 24, 1977) directs all federal agencies to refrain from assisting or giving financial support to projects that encroach on public or privately owned wetlands.

2.4.8 Executive Order 12898, Environmental Justice

On February 11, 1994, President Clinton issued Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations." The purpose of the order was to ensure that federal actions and policies do not result in the disproportionate placement of adverse environmental, economic, social, or health impacts on minority and low-income populations. By memorandum on February 11, 1994, the President directed EPA to ensure that agencies analyze environmental impacts (including human health, social, and economic impacts) of proposed projects on minority and low-income communities. This EIR/EIS includes analysis of the socioeconomic and environmental justice impacts of the proposed project (see Chapter 4).

2.4.9 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC 703) enacts the provisions of treaties between the United States, Great Britain, Mexico, Japan, and the Soviet Union and authorizes the U.S. Secretary of the Interior to protect and regulate the taking of migratory birds. The MBTA is administered by the USFWS, and sets seasons and bag limits for hunted species and protects migratory birds, their occupied nests, and their eggs (16 USC 703, 50 CFR 21, 50 CFR 10). It is a strict-liability law that incorporates no requirement to prove intent to violate any of its provisions. Wording in the MBTA makes it clear that most actions that result in "taking" or possession (permanent or temporary) of a protected species can be a violation of the Act. The word *take* is defined as meaning "pursue, hunt, shoot, wound, kill, trap, capture, or collect, or attempt to pursue, hunt, shoot, wound, kill, trap, capture, or collect" (50 CFR 10.12). The provisions of the

MBTA are nearly absolute; "except as permitted by regulations" is the only exception. Examples of permitted actions that do not violate the law are the possession of a hunting license to pursue specific gamebirds, legitimate research activities, display in zoological gardens, bird-banding, and similar activities (Faanes et al. 1992)

2.4.10 Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, also known as the Superfund Act) of 1980 (PL96-510) is administered by EPA. It is intended to protect the public and the environment from the effects of prior hazardous waste disposal and new hazardous material spills. CERCLA provides funds to compensate victims and to decontaminate the environment. The Superfund Amendments and Reauthorization Act (SARA) of 1986 (PL-99-499) amends some provisions of CERCLA and provides for a Community Right-to-Know program.

2.4.11 Resource Conservation and Recovery Act

The EPA also administers the Resource Conservation and Recovery Act (RCRA) of 1976 (PL 94-580), along with the Hazardous and Solid Waste Amendments (HSWA) of 1984. This legislation provides the principal regulation for the storage, transportation, and disposal of both solid and hazardous waste. RCRA imposes reporting and permitting requirements, and provides for operational control on those who generate, treat, store, transport, or dispose of hazardous waste.

Chapter 3. Project Area Background

This section provides an overview of existing site conditions and describes how these conditions significantly influence the suitability of the project area for habitat restoration. Information discussed in this section provides the basic framework for developing and analyzing the project approaches, developing specific design considerations, and developing and analyzing the preferred alternative. Project area characteristics are grouped by the following topics:

- Geomorpholgy, Hydrology, and Hydraulics
- Soils and Groundwater Hydrology
- Vegetation
- Fisheries
- Land Use, Infrastructure, and Public Health and Safety
- Cultural Resources

3.1 GEOMORPHOLOGY, HYDROLOGY, AND HYDRAULICS

3.1.1 Geomorphology

3.1.1.1 Introduction

The description of Guadalupe Creek geomorphology is divided into four parts. The first part provides a brief overview of the geologic and geomorphic setting of the Guadalupe Creek basin. The second part provides detailed geomorphic description of the project reach, which is located between Masson Dam and the Almaden Expressway. The third part examines the historical evolution of lower Guadalupe Creek, including changes in channel planform, bed profile, and cross section, and identifies key historical events that have contributed to this evolution. The fourth part provides a synthesis of historical trends and identifies future trends that can be expected in the project reach.

Data Collection and Previous Studies. Information for this geomorphic investigation was obtained from several key sources, including the District, the U.S. Army Corps of Engineers (Corps), the University of California, California State University, and the California State Library systems. In addition, journal article databases covering publications in water resources and engineering were searched for information relating to Guadalupe Creek. A complete list of reviewed documents is provided in Chapter 9. A list of historical aerial photographs collected for this project is shown in Table 3-1, and a list of historical topographic maps is shown in Table 3-2. In addition to the collection of reports, plans, maps, and aerial photographs, a detailed onsite field investigation was conducted during a 1 week period in November 1999. A series of geomorphic, soils, and vegetation maps produced during this site inventory are shown in Appendix A of this report.

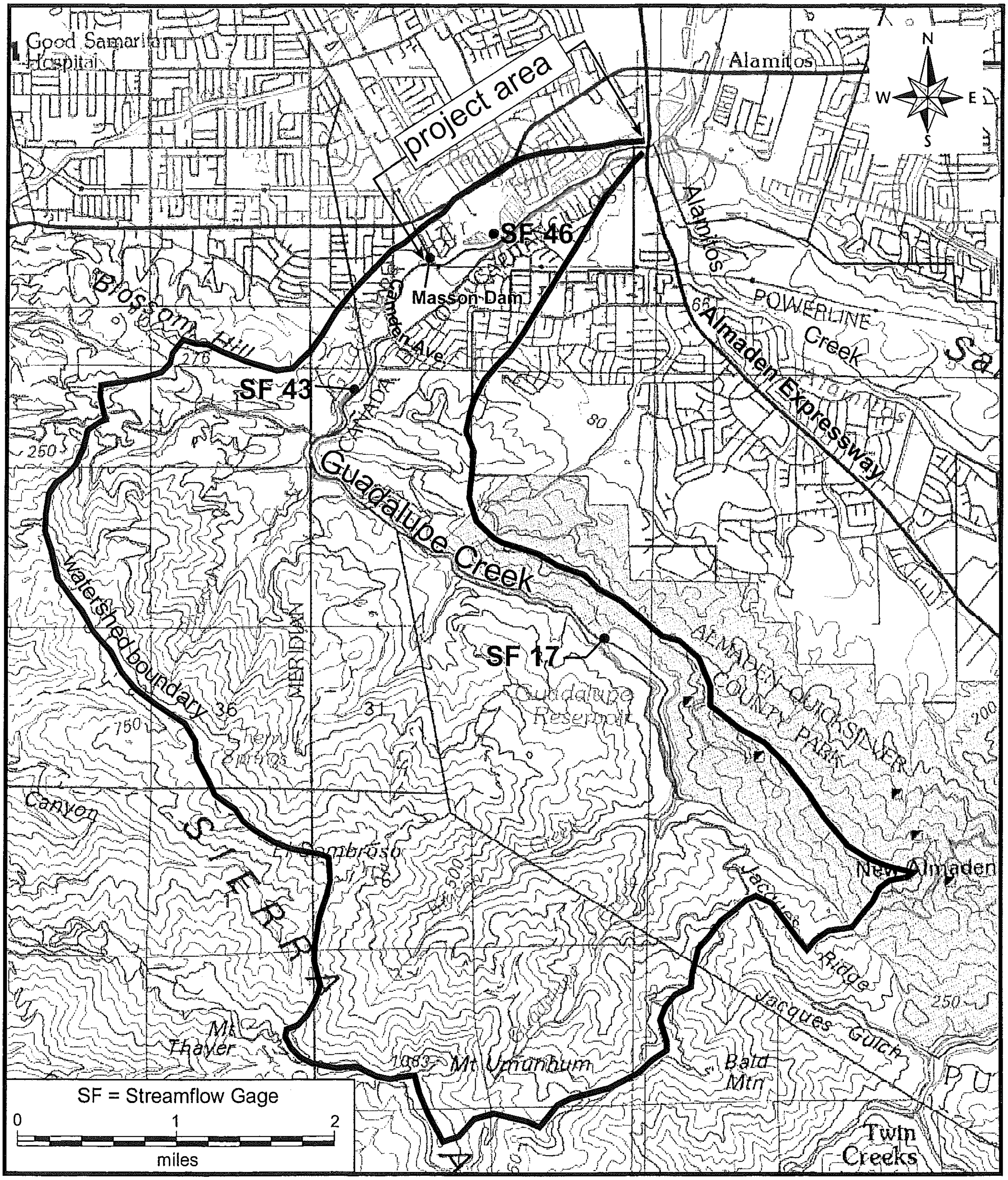
3.1.1.2 Physiography

Guadalupe Creek originates in the steep terrain of the Santa Cruz Mountains and flows north to the Santa Clara Valley where Guadalupe Creek meets Alamitos Creek to form the Guadalupe River (Figure 3-1). Mt. Umunhum, at 3,486 feet, is the highest point in the Guadalupe Creek basin. Major tributaries to Guadalupe Creek are Rincon, Los Capitancillos, and Pheasant Creeks. About 90% of the basin is located in the Santa Cruz mountains and 10% in the Santa Clara Valley. The Guadalupe Creek drainage basin is 15.2 square miles. The upper 6 square miles of the drainage basin is regulated by Guadalupe Dam, which was constructed in 1935. The dam is operated by the District for water supply purposes and has a storage capacity of 3,740 acre feet. Masson Dam, located on Guadalupe Creek at the upstream limit of the project area, is a small diversion dam operated during the summer months to provide water to the Los Capitancillos percolation ponds.

Mountainous areas of the drainage basin are largely undeveloped, whereas the lower part of the basin in Santa Clara Valley is heavily populated, consisting of residential housing tracts and light industry. Guadalupe Creek is geologically confined in the Santa Cruz Mountains and confined by levees in the lower reach in Santa Clara Valley. The levees begin near Masson Dam, the upstream limit of the project area, and extend to Almaden Expressway where Guadalupe Creek meets Alamitos Creek to form the Guadalupe River.

Geology. The Guadalupe Creek basin is dominated by highly fractured and faulted sedimentary rocks of the Franciscan Complex. These rocks are highly erodible and primarily composed of sandstone and shale, with lesser quantities of chert, limestone, greenstone, and conglomerate (California Division of Mines and Geology 1990). Other rock types in the basin include volcanic, metavolcanic, and ultramafic (mostly serpentine) rocks. Rocks of the Franciscan Complex are very susceptible to mass wasting processes, such as landslides, rockfalls, and debris flows. Mass wasting tends to be concentrated in higher elevations that receive greater annual rainfall and along stream channels that undercut unstable slopes (Radbruch and Crowther 1973). Mass wasting on a large scale is normally triggered by large storms or seismic events, evidenced by the thousands of landslides that occurred following both the storms of January 1982 (U.S. Geological Survey 1988) and the magnitude 7.1 Loma Prieta Earthquake in 1989 (California Division of Mines and Geology 1992).

The Guadalupe Creek basin is bordered by the Sargent Fault and the San Andreas Fault Zone, located approximately 2 and 4 miles west of the basin, respectively, and by the Hayward Fault Zone and the Calaveras Fault, located approximately 11 miles east of the basin. Large seismic events similar to the Loma Prieta earthquake, which had its epicenter 4 miles south of the basin, are expected to continue along these faults. Numerous smaller faults are found crossing through the Guadalupe Creek basin, most notably the Berrocal Fault Zone. Guadalupe Creek flows to the northwest along the structural alignment of the Berrocal Fault Zone for approximately 2 miles



Jones & Stokes
nhc

Figure 3-1
Guadalupe Creek Drainage Basin and Project Area

Table 3-1. Historical Aerial Photographs

Aerial Photograph Date	Source	Type	Scale	Series	Print Number(s)	Notes
1939	U.S. Agricultural Adjustment Association	B&W	1:20,000	CIV 285	22, 50, 96	Full coverage
1948	USGS	B&W	1:23,600	GS - HR	1-5, 58; 2-168	Full coverage
1950	USDA ASCS	B&W	1:20,000	CIV 17G CIV 16G	41; 178	Full coverage
1963	USDA ASCS	B&W	1:20,000	CIV 1DD CIV 6DD	184; 66	Full coverage
2/23/1967	District	B&W	1:6,000	65C3 BC	1–7	Full coverage
10/19/70	District	Blueline	1:600	N/A	N/A	As-built plans Guadalupe Creek Project 30026
7/29/1975	District	B&W	1:3,000	none	1–5	Partial coverage, from upstream limit of project reach to upstream from Meridian Avenue
1980	USDA ASCS	B&W	1:40,000	40 06085	179-129	Full coverage
1987	USGS	B&W	1:40,000	519-83	none	Full coverage
7/31/1998	District	Color	1:4,200	000414	151–15-6 ; 17-1–17-9; 16-1–16-6	Full coverage
8/17/1999	Air Flight Services	B&W	1:4,200	N/A	N/A	Full coverage

Notes:
USGS = U.S. Geological Survey.
USDA = U.S. Department of Agriculture.
ASCS = Agriculture Stabilization and Conservation Service.
District = Santa Clara Valley Water District.
B&W = Black and white.
N/A = Not applicable.

Table 3-2. Historical Topographic Maps

Map Name	Author	Edition	Surveyed	Scale	Contour Interval (feet)	Notes
Santa Teresa, California	USGS	1980	1953	1:24,000	10	Photorevised with 1978 aerial photographs
Los Gatos, California	USGS	1980	1953	1:24,000	10	Photorevised with 1978 aerial photographs
Santa Teresa, California	USGS	1968	1953	1:24,000	10	Photorevised with 1968 aerial photographs
Los Gatos, California	USGS	1968, 1973	1953	1:24,000	10	Photorevised with 1968 and 1973 aerial photographs
Los Gatos, California	USGS	1968	1953	1:24,000	10	Photorevised with 1968 aerial photographs
Santa Teresa, California	USGS	1953	1953	1:24,000	10	Aerial photographs taken 1948
Los Gatos, California	USGS	1953	1953	1:24,000	10	Aerial photographs taken 1948
Los Gatos, California	U.S. War Department	1940	1915–16	1:62,500	50	Aerial photographs taken 1937
Los Gatos, California	USGS	1919	1915–16	1:62,500	25	Reprinted in 1942
Township 8 South, Range 1 East (T8S, R1E)	U.S. Surveyor General	3/24/1880	1858– 79	1:31,680	None	Township plat map
Map of the Original Locations of the Guadalupe Mine	A.T. Herrmann and C.T. Healey	1878	7/22/1878	1:23,760	None	Cloth map in color, produced by county surveyor
Plat of the Part of the Rancho Canada de Los Capitancillos finally confirmed to the Guadalupe Mining Company	U.S. Surveyor General	8/7/1871	1865– 71	1:15,840	None	None
Map of the Lands of the Guadalupe Mining Company	A.T. Herrmann	1871	1871	1:31,680	none	Produced by county surveyor

Note: USGS = U.S. Geological Survey.

downstream from Guadalupe Reservoir before it turns sharply to the northeast to exit the Santa Cruz Mountains and flow into the Santa Clara Valley.

The Santa Clara Valley is located in a structural depression of the Coast Range that has slowly infilled with sediments, creating a broad alluvial valley floor with deposits several tens of meters thick (Norris and Webb 1990). Lower Guadalupe Creek flows on sediments deposited in an alluvial fan environment created as sediment-laden flows exited the Santa Cruz mountains and spread out onto the valley slope. The fan is irregularly shaped, due to geologic control by the Santa Teresa Hills and unnamed hills located just east of the project reach. The alluvial fan sediments are late Pleistocene (less than 500,000 years old) and younger, consisting of weakly consolidated, poorly sorted, irregularly interbedded clay, silt, sand, and gravel (Figure 3-2). The lower Guadalupe Creek project reach is underlain by coarse-grained Holocene (less than 10,000 years old) alluvium, characterized by unconsolidated, moderately sorted, permeable sand and silt with coarse sand and gravel (U.S. Geological Survey 1979).

Land Subsidence. The Santa Clara Valley experienced substantial land subsidence due to groundwater overdraft from approximately 1900 to 1965, the year state water deliveries began to arrive in the San Jose area. Measured land subsidence recorded in downtown San Jose at the corner of North 1st Street and St. James Street was 14.1 feet from 1906 to 1995, with 13.0 feet (92% of total) occurring before 1966 (Santa Clara Valley Water District 1995a). Guadalupe Creek is located more than 5 miles from the zone of maximum subsidence and more than 1 mile upstream from the zone affected by land subsidence. This distance and the creek's location on the relatively steep, outer margin of Santa Clara Valley makes it unlikely to have been significantly affected by land subsidence. In addition, District efforts to counteract land subsidence through the use of percolation ponds on Guadalupe Creek may have locally reduced the total amount of land subsidence in this part of the Santa Clara Valley. However, changes on Guadalupe River caused by land subsidence may have impacted areas upstream, including Guadalupe Creek.

3.1.1.3 Project Area

Overview. The project area is approximately 8,700 feet in length and located along an urbanized section of lower Guadalupe Creek between the Almaden Expressway Bridge (station 11+00) and Masson Dam (station 98+00). Detailed maps of the project area are shown in Appendix B. River stationing in these maps is based on flood studies conducted by the Corps (1973).

Key structural features in the project area include the Meridian Avenue Bridge at station 54+00 and a sloped concrete wall extending 1,500 feet along the south bank from station 28+00 to 43+00. A levee bounds the north side of the creek and protects the Los Capitancillos percolation ponds and adjacent residential area. The south side of the creek is bordered by Coleman Road from Almaden Expressway to station 78+00, where the road diverges from the creek and a low berm 1–3 feet high continues from station 80+00 to station 92+00. This combination of levee, berm, and grade elevation of Coleman Road acts to confine high flows to a narrow flood corridor, preventing them from spreading onto the historical floodplain and flooding residential subdivisions.

The flood corridor in most of the project area is relatively straight from Almaden Expressway to station 76+00. Further upstream, the flood corridor exhibits two small bends at station 78+00 and station 95+40, located at the beginning and end of a large field adjacent to the creek. Channel sinuosity in the project area is very low, 1.07, where sinuosity is calculated by dividing the channel length by the length of the flood corridor. Although fairly straight, several gradual meanders are present in the creek channel and a meander bend that turns abruptly is located at station 47+00.

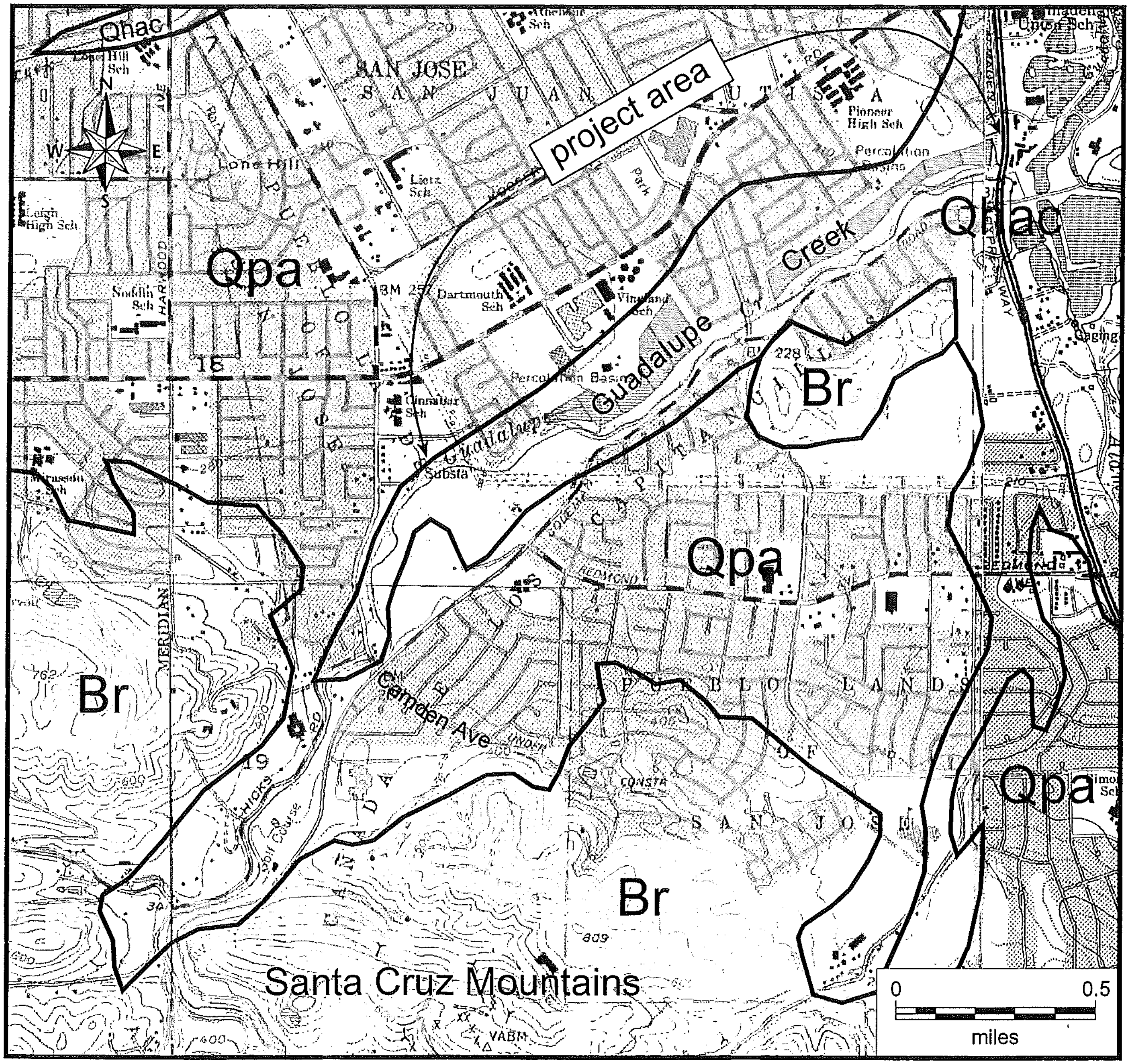
The creek channel is well defined along the entire project area and characterized by pools, runs, and riffles. At the time of field reconnaissance in November 1999, 60% of the creek length in the project area was characterized by riffles, 25% by pools, and 15% by runs. Areas characterized as good fish habitat with either undercut banks or pools in excess of 18 inches deep were limited.

Bed and bank material in the project area ranges from silt and clay to large cobbles. Very few areas in the project reach present gravel bed material suitable as fish spawning habitat. Most of the creek exhibits some degree of instream aquatic vegetation. Channel banks are largely composed of unconsolidated and unstratified gravel, sand, silt, and clay. Some areas are partially consolidated and resistant to erosion, particularly in the upstream part of the project area. No major rock outcrops or abrupt changes in stream bed profile were identified in the project area.

Although relatively short, 1.6 miles, the project area exhibits significant changes in channel morphology with distance downstream. In the upstream section, from station 74+00 to station 98+00, the creek exhibits a confined, narrow channel cross section with steep, high banks. In contrast, the downstream reach from station 11+60 to station 44+40 is characterized by a wide channel bottom with large, alternating gravel bars and a wide, intermediate-level floodplain bench adjacent to the north bank levee. These key changes in reach morphology are used to identify distinct geomorphic reaches, described below.

Geomorphic Reaches. Key characteristics and changes in channel morphology along the project area reveal four distinct geomorphic reaches (Figure 3-3): Reach 1 (station 11+60 to 44+40), Reach 2 (station 44+40 to station 59+00), Reach 3 (station 59+00 to station 74+00), and Reach 4 (station 74+00 to station 98+00). Key geomorphic characteristics of each reach are identified below.

Reach 1 (station 11+60 to station 44+40) is 3,280 feet long and located at the downstream end of the project area from Almaden Expressway to station 44+40, approximately 1,000 feet downstream from Meridian Avenue. This reach is characterized by large, alternating gravel bars that create a broad channel bottom, resulting in wide, shallow flow at relatively low flows. These gravel bars store sediment for later transport downstream and also act as sites for future sediment deposition. A broad floodplain bench, approximately 5 feet above the channel bed, extends along much of the north bank in this reach. The bench is located at an intermediate level between the top of the levee and the channel bed. The bench is a constructed feature created during the 1972 flood corridor expansion, discussed later in this report. The south side of the channel is characterized by a steep slope that rises more than 10 feet with few intermediate bench surfaces. Tree cover over the creek in this reach is the lowest of any of the four geomorphic reaches.



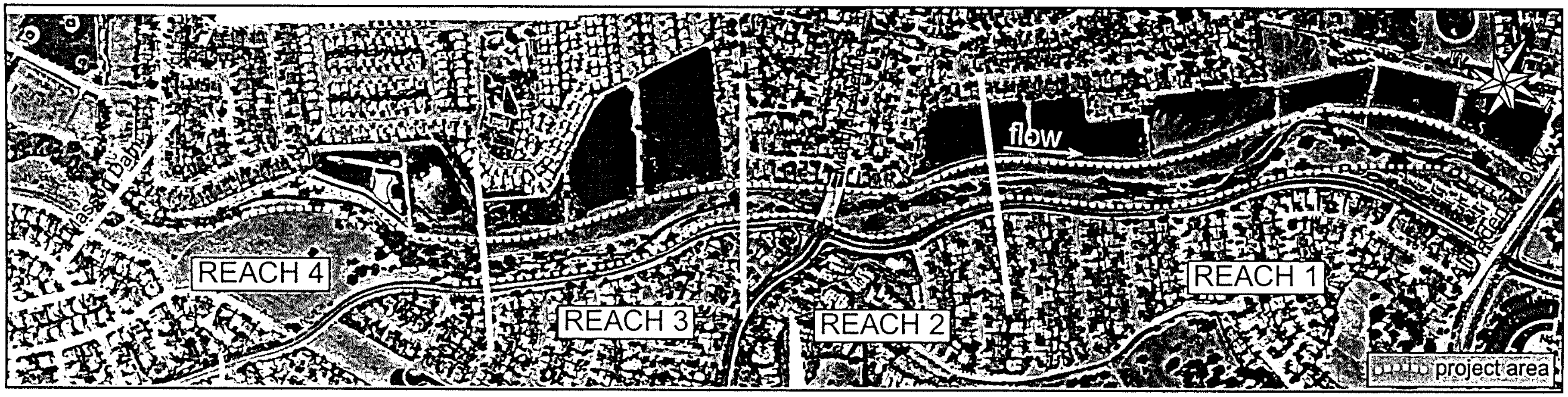
LEGEND

Qpa	LATE PLEISTOCENE ALLUVIUM - Weakly consolidated, slightly weathered, poorly sorted, irregularly interbedded clay silt, sand, and gravel
Qhac	COARSE-GRAINED ALLUVIUM - Unconsolidated, moderately sorted, permeable sand and silt with coarse sand and gravel; more abundant toward fan heads
Br	UNDIVIDED BEDROCK - Older than Pleistocene

Source: U.S. Geological Survey 1979.

Jones & Stokes
nhc

Figure 3-2
Geologic Units in Immediate Vicinity of Project Area



Jones & Stokes
nhc

Figure 3-3
Delineation of Geomorphic Reaches in
Lower Guadalupe Creek Project Area

Reach 2 (station 44+40 to station 59+00) is 1,460 feet long and spans a short section of the project area extending to either side of Meridian Avenue Bridge. Unlike Reach 1, this reach exhibits no large gravel bars and has a much more confined channel cross section, with small intermediate-level benches that alternate between the left and right banks. The flood corridor in Reach 2 narrows to about 150 feet wide where it passes between residential development and Coleman Avenue just upstream from the Meridian Avenue Bridge. This narrowing is due to development on the north side of the creek that restricted widening of the flood corridor during the 1972 flood corridor expansion (Section 3.1.1.4, "Historical Geomorphology").

Reach 3 (station 59+00 to station 74+00) is 1,500 feet long and characterized by a very wide (100+ feet) floodplain bench on the north bank that extends continuously for approximately 1,500 feet. This bench is, on average, approximately 7 to 8 feet above the channel bed and was constructed during the 1972 flood corridor expansion. Six large trees on this bench were preserved in 1972 by grading around them, leaving raised mounds as high as 5 feet in the upstream part of the reach (station 73+20). The elevation of these mounds identifies the former ground surface prior to cutting the new floodplain bench in 1972. The floodplain bench ends near station 74+00, delimiting the upstream extent of this reach. The south bank of this reach exhibits a steep slope that varies from 12 to 20 feet high and rises to the elevation of Coleman Road. Tree cover in this reach is significantly higher than in Reaches 1 and 2.

Reach 4 (station 74+00 to station 98+00) is 2,400 feet long and located at the upstream end of the project area. Reach 4 exhibits an entrenched channel cross section that is narrow and confined when compared to the other geomorphic reaches. There are a few small intermediate-level benches in this reach, but in most cases the channel exhibits steep-sided banks that rise more than 10 feet to the top of the floodplain. This type of cross section results in greater confinement of floodflows, allowing for higher sediment transport capacity than in downstream reaches. Masson Dam, located at the upstream end of this reach, was not present at the time of field survey due to its removal for construction of the new fish ladder and dam. Some erosion of sediments that had accumulated behind the former dam site was observed. Trees along the riparian corridor were more numerous in Reach 4 than in any of the downstream reaches, particularly in the vicinity of the stream bend at station 79+00.

The variability in flow conditions created by these geomorphically distinct reaches can be quantified by examining the hydraulic characteristics of small (2-year) and large (100-year) flood events (Table 3-3). The parameters in Table 3-3 identify reach-averaged values for active flow top width, maximum and mean flow depth, and energy slope in each geomorphic reach. Active flow top width is defined as that part of the total flow top width that is actively conveying flow downstream. Thus, it does not include backwater areas where flow velocity is near zero. Energy slope is a measure of changes in stream energy with distance downstream. The last column in Table 3-3 summarizes key characteristics of each geomorphic reach. The values presented in Table 3-3 are drawn from hydraulic modeling results presented in the Hydraulics portion of this report. However, these results are useful here to illustrate the differences in flow width, depth, and energy slope between geomorphic reaches for 2-year and 100-year floodflows.

Two key observations for the 2-year flow can be seen in Table 3-3. First, the active flow top width in Reach 1 is much wider and shallower than the other three reaches, reflecting the wide, shallow flow that occurs over the gravel bars in this reach. Second, the energy slope in Reach 4 is the highest of all four geomorphic reaches. The higher energy slope reflects the relatively confined and narrow cross section of this reach, which results in higher velocities and higher capacity to transport sediment downstream.

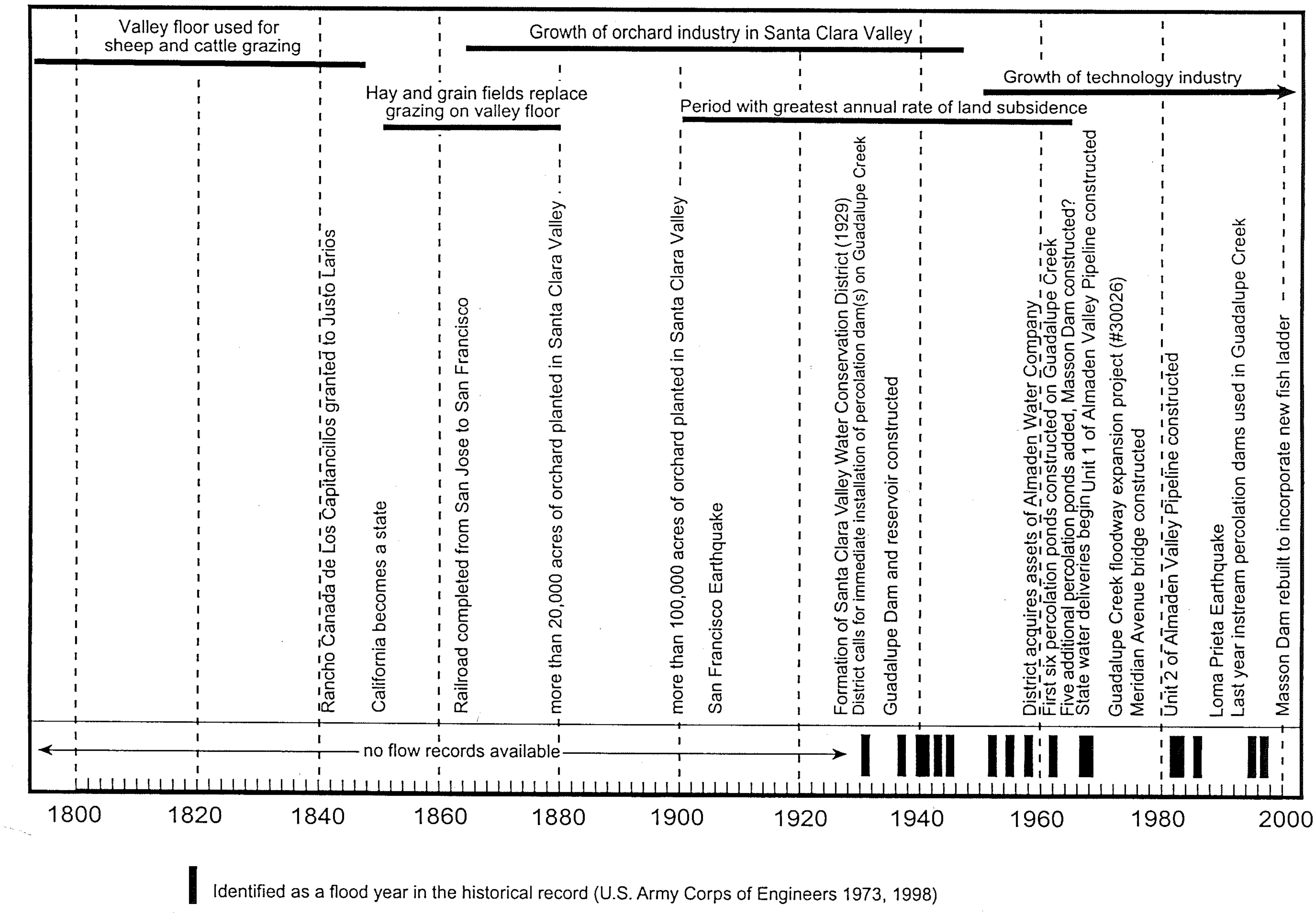
Two key observations are evident from the 100-year flow in Table 3-3. First, Reaches 1 and 3 exhibit a flow configuration that is wider and shallower than in Reaches 2 and 4. This reflects the similarities between Reaches 1 and 3 where broad, intermediate-level floodplain benches are present versus Reaches 2 and 4 which exhibit a more narrow, confined cross-section geometry. Second, Reach 4 exhibits a significantly greater energy slope than do Reaches 1, 2, and 3, indicating that higher sediment transport capacity is maintained in this reach for the 100-year flow.

3.1.1.4 Historical Geomorphology

The objective of this portion of the report is to document the historical evolution of lower Guadalupe Creek from available maps, aerial photographs, and documents. Specific attention is paid to documenting changes in channel planform, bed profile, cross-sectional geometry, and historical levels of SRA cover vegetation. Key events that have contributed to these changes are identified from the historical record. Historical maps, aerial photographs, and documents reviewed for this portion of the report are listed in Tables 3-1 and 3-2 and in Chapter 9, respectively.

Timeline. A chronology of significant events pertaining to the history and evolution of lower Guadalupe Creek is presented in Figure 3-4. Events spanning several years are indicated along the top of Figure 3-4, whereas events occurring in specific years are oriented vertically. Historical flood years are indicated by black bars along the x-axis.

The historical chronology of lower Guadalupe Creek begins with Spanish exploration in 1769 and the establishment of a mission in 1777 at what is now the city of San Jose. The region experienced very slow growth for the next several decades, with surrounding lands used primarily for sheep and cattle grazing. In 1842, the lands around lower Guadalupe Creek were granted to Justo Larios and named the Rancho Cañada de Los Capitancillos. Following California statehood in 1850, American and European settlers began to arrive in large numbers. Grazing was replaced by hay and grain fields on the valley floor but continued in the hills surrounding Santa Clara Valley. The lands of the Rancho Cañada de Los Capitancillos were purchased by the Guadalupe Mining Company sometime before 1871, the year a map was produced defining the limits of the property (Table 3-2). The specific use of the land is unclear, but areas further upstream in the Santa Cruz Mountains were mined for mercury. By 1864, the railroad between San Jose and San Francisco was completed, opening a vast new market for the valley's fledgling orchard industry. By 1880, more than 20,000 acres in the valley were covered by fruit trees, and by 1900, more than 100,000 acres were planted. Canning became the valley's first major industry.



Jones & Stokes
nhc

Figure 3-4
Historical Timeline of Significant Events on Lower Guadalupe Creek

Table 3-3. Reach-Averaged Hydraulic Characteristics of Geomorphic Reaches for 2-Year and 100-Year Flood Events

	Hydraulic Characteristics[a]								
	Active Flow Top Width (feet)		Maximum Flow Depth (feet)		Mean Flow Depth (feet)		Energy Slope[b] (feet per feet)		
Reach	2-Year Flow	100-Year Flow	2-Year Flow	100-Year Flow	2-Year Flow	100-Year Flow	2-Year Flow	100-Year Flow	Notes
Reach 1 (station 11+60 to 44+40)	66.7	171.1	3.1	7.8	1.5	3.7	.0053	.0052	Wide, unconfined channel cross section and flood corridor; large alternating gravel bars; wide channel bottom; intermediate-level floodplain bench on most of north bank; depositional, sediment storage reach.
Reach 2 (station 44+40 to 59+00)	38.5	118.6	4.0	9.6	2.1	4.7	.0061	.0058	Relatively confined flood corridor; narrows through Meridian Avenue Bridge; no large floodplain benches.
Reach 3 (station 59+00 to 74+00)	28.1	170.2	4.1	9.9	2.7	3.4	.0054	.0058	Wide, unconfined flood corridor; large intermediate-level floodplain bench on north bank; several trees on raised mounds of earth left after 1972 excavation work.
Reach 4 (station 74+00 to 98+00)	30.3	99.8	3.8	9.9	2.4	4.7	.0072	.0080	Confined flood corridor and entrenched channel cross section; some small intermediate-level floodplain benches; very few bars; highest tree cover in project area; high sediment transport capacity reach.

Notes:

[a] All values denote average for each reach.

[b] The reach average energy slope is calculated by dividing the difference in the total energy between the upstream and downstream ends of the reach by the reach length.

Widespread overpumping of groundwater for agricultural needs resulted in land subsidence of the valley floor, prompting the first field measurements to be taken in 1906 (Santa Clara Valley Water District 1995a). A plan of action to address this problem was formulated by the Santa Clara Valley Water Conservation Committee in 1920. The plan included the construction of a series of dams and reservoirs to increase groundwater percolation and improve water storage for irrigation uses (McArthur 1981). The plan was voted down by Santa Clara Valley's residents in 1921 but area farmers raised money and began implementing the plan on a small scale. This included the construction of percolation dams on area creeks, though no specific locations are mentioned by McArthur (1981). In 1929 the Santa Clara Valley Water Conservation District was formed following the passage of the Water Conservation Act. After conducting a field inspection in November 1929, the District decided that the immediate construction of instream winter percolation dams on Guadalupe, Almaden, and Lost Gatos Creeks was necessary.

A 1933 plan sheet obtained from the District shows one instream percolation dam constructed on Guadalupe Creek just upstream from Almaden Expressway and a second dam on Alamitos Creek at the confluence with Guadalupe Creek (Santa Clara Valley Water District 1933). Both dams were constructed to provide groundwater recharge to the Santa Clara Valley aquifer, offsetting land subsidence caused by groundwater overdraft. The number, location, and duration of percolation dams used on Guadalupe Creek from 1933 to 1986 is unclear. It is known, however, that two instream percolation dams were in use on Guadalupe Creek for an unknown period until 1986, when two additional dams were added (Aguilera pers. comm.). All four instream dams were constructed from gravel and removed each winter so that floodflows could pass unimpeded. The gravel material was stockpiled for reuse in spring when the instream dams were reinstalled. The percolation dams were part of a larger program that included 44 dams distributed over 11 different streams (Santa Clara Valley Water District 1995b).

Guadalupe Dam was constructed in the upper Guadalupe Creek basin in 1935 for water supply purposes. Agriculture in Santa Clara Valley peaked around 1950, and in the following years, from 1950 to the mid 1960s, a transformation from agriculture to industrial and residential land uses occurred over much of the valley, including the north side of lower Guadalupe Creek. Historical maps also indicate that parts of lower Guadalupe Creek had been actively mined for gravel prior to 1962, the year the percolation ponds were constructed.

In 1962, the first six ponds of the Los Capitancillos percolation pond system were constructed along the north side of the creek. Five additional ponds were added in 1964. Aerial photographs from 1963 show percolation ponds being constructed near Almaden Expressway, which suggests that the upstream percolation ponds were constructed first, followed by the ponds near Almaden Expressway. All of the percolation ponds were protected by a levee that confined creek flows to a narrow flood corridor. This levee reduced the likelihood of flooding adjacent to the creek channel during winter storms; however, it also increased the likelihood of channel degradation because floodflows were concentrated in a more narrow flood corridor.

Masson Dam was constructed some time before April 1964, the date the dam appears as an existing feature on general plans for percolation pond construction (Santa Clara Valley Water Conservation District 1964). District records indicate that the dam was probably built just before the construction of the five percolation ponds located upstream from Meridian Avenue (Aguilera 2000). This time frame would put the time of dam construction somewhere after 1962 but before April 1964.

Masson Dam was approximately 5.5 feet high. Wood flashboards were added during the summer months to divert flows from Guadalupe Creek to the Los Capitancillos percolation ponds. In some years, when flows were not released from Guadalupe Reservoir, the flashboards were left in place to divert flows throughout the winter (Aguilera 2000). A concrete settling basin approximately 45 feet long and 3 feet high was also constructed downstream from the dam. Flows overtopped the dam, flowed through the settling basin, and returned to the creek channel bed approximately 50 feet downstream from the dam.

Maintenance of the dam was required annually. Gravel material was removed from upstream from the dam each spring after the winter flows (Aguilera 2000). Some time between 1964 and 1987, a gate valve was installed and a concrete headwall added so that creek flows could pass around rather than over the top of the dam. This allowed creek flows to transport gravel material around the dam and back into Guadalupe Creek, greatly reducing the amount of gravel accumulation upstream from the dam and the need for annual maintenance.

Prior to Masson Dam, another dam existed approximately 800 feet further upstream. This gravel dam was used for the diversion of summer flows for irrigation. The dam cannot be clearly seen in historical aerial photographs. The irrigation ditch leading from the dam is visible in 1948 aerial photos but not in 1939 photos, indicating that the dam was constructed some time between these two dates. The dam was abandoned in 1958 when the District acquired the assets of the Almaden Water Company, which owned the dam. In 1966, the District constructed Unit 1 of the Almaden Valley pipeline to deliver water from Vasona Pump Station to Guadalupe Creek, and in 1982 Unit 2 of the Almaden Valley pipeline was constructed, allowing for the transfer of water from Guadalupe Creek to Calero Dam.

Due to flooding concerns over new development along lower Guadalupe Creek, the flood corridor was widened in 1972. The Los Capitancillos percolation ponds were reduced in size, set back from the flood corridor, and a new levee constructed, more than doubling the width of the flood corridor in some areas. The new levee was raised several feet above the level of the existing levee and was constructed to match the elevation of Coleman Road, a four-lane boulevard constructed along the south bank of the creek between 1970 and 1972. The new flood corridor was contoured to provide broad, intermediate benches between the new percolation pond levee and Guadalupe Creek. Large trees in the flood corridor were preserved during construction and sometimes appear on raised mounds in areas where the surrounding land was graded lower to increase flood capacity. Detailed cross-section information showing changes made to the channel flood corridor are presented with more detailed discussion later in the "Historical Channel Bed Profile and Cross Sections" portion of this section. Other significant structural changes in the creek included construction of the Meridian Avenue Bridge in 1976. In 1999, Masson Dam was removed so that a new dam incorporating a fish ladder could be constructed. Construction is scheduled for completion in the year 2000.

In 1994, the construction of summer instream percolation dams that had occurred in lower Guadalupe Creek since 1933 was halted due to the expiration of existing permits. Nonrenewal of these permits was likely influenced by the fact that groundwater levels in San Jose had returned to near presubsidence levels and that, since the beginning of state water deliveries to the San Jose area in 1965, less than 1.5 feet of additional land subsidence has occurred in San Jose (Santa Clara Valley Water District 1995a).

Several large floods have occurred during the history of lower Guadalupe Creek and are identified along the base of the time line in Figure 3-4. No information about the extent of channel changes caused by these floods was identified for the project area. Annual peak flow data from the streamflow gage at Camden Avenue, however, indicate that the 1958, 1983, 1986, and 1995 floods were among the largest for the period from 1930 to present. These data are reviewed in detail in Section 3.1.2, "Hydrology".

Historical Channel Planform. Historical maps and aerial photographs of lower Guadalupe Creek are available from 1871 to present (Tables 3-1 and 3-2). A series of topographic maps from Table 3-2 and a 1999 orthogonally rectified aerial photograph from Table 3-1 were selected to create a planform shift map that illustrates shifts in the location of Guadalupe Creek over time (Figure 3-5). Map dates in Figure 3-5 refer to the year of aerial photography on which the map is based and not the date of map publication (Table 3-2). The date of aerial photography represents the year in which the channel planform was observed and usually precedes the year of map publication. Maps and the 1999 aerial photographs were aligned based on common reference points, including lines of latitude and longitude, township and range, and cultural features, such as roads and property lines.

Figure 3-5 shows that the channel planform has remained relatively consistent for the historical period of record, though there is substantial variability about this general trend through time. Much of this variability can be attributed to errors in the 1878 and 1937 maps. When overlaid on more recent topography, these older maps show very substantial divergences in the location of township and range lines and cultural features, found to be as much as 250 feet in some locations. Thus, only the most significant deviations from the current channel alignment are examined in the 1878 and 1937 planform maps. In contrast, channel planform from 1948, 1978, and 1999 is nearly identical in most locations, reflecting general stability in the river channel for the period.

The greatest divergence in channel planform from 1878 to 1999 is located in the downstream section of the project area where the 1878 channel alignment exhibits a small meander bend in a location now occupied by percolation ponds (Site A in Figure 3-5). The 1878 map provides no information as to why this meander is present; however, 1871 mapping reveals this area as having had multiple flow channels and a broad channel bed, as defined by the county surveyor A. T. Herrmann (Figure 3-6). Thus, the present location of the percolation ponds in this reach lie on what was at one time a section of braided stream channel.

The 1937 channel planform exhibits a significant deviation from later 1948, 1978, and 1999 channel alignments at the upstream-most percolation pond where the 1937 channel is located about 350 feet south of the 1948 channel alignment (Site B in Figure 3-5). Examination of 1939 aerial photographs show, however, that no such channel alignment existed in 1939, but rather that it followed the same alignment as shown in 1948 topography. This, in addition to inconsistencies in the locations of cultural boundaries relative to 1948 and 1978 mapping, casts significant doubt as to the accuracy of 1937 War Department maps.

Comparison of 1948 and 1978 channel alignments show the creek to have had little or no change within the project area with two exceptions. The first is located at Site B in Figure 3-5, where the creek appears to have shifted approximately 150 feet to the south between 1948 and 1978. Proximity of the 1948 creek alignment to the percolation ponds suggests that this channel shift may be due to an engineered change in creek alignment made during construction of the percolation ponds in the early 1960s. A smaller but similar shift is also observed next to the third pond upstream from Almaden Expressway. This channel shift is also likely due to creek relocation during construction of the percolation ponds in the 1960s, given that the ponds in this location once extended further south than they do today.

The 1999 channel alignment is similar to the 1978 alignment, though there are many small deviations from 1978 in Figure 3-5. These deviations are due in part to limitations in aligning 1999 aerial photographs precisely with the 1978 topographic map. Some of this deviation, however, represents channel migration. In general, the 1999 channel alignment deviates more from the 1978 alignment in the area downstream from the Meridian Avenue Bridge. This part of the creek is characterized by a series of large, alternating gravel bars with a wider channel bottom than in upstream reaches. This morphology allows greater freedom for creek channel migration as compared with more confined reaches upstream and is a likely cause of the observed channel migration in Figure 3-5.

Historical Land Use. Historical aerial photographs were examined to identify changes that occurred along lower Guadalupe Creek and the surrounding area through time. A comparison of the earliest available aerial photographs (1939) is made with recent (1999) aerial photographs in Figure 3-7. Figure 3-7 shows agricultural fields and orchards bordering the project area in 1939, whereas residential area and percolation ponds are the prominent features in 1999. Although land use changes dramatically from 1939 to 1999, the frequency and density of riparian tree cover remains comparable between the two photographs. Similarly, both time periods show very few areas where the creek is obscured by overhanging vegetation. Comparison of the 1939 and 1980 aerial photographs over a larger area of the creek shows a similar correspondence as well as a general decline in the density of riparian tree cover with distance downstream from the Camden Avenue Bridge (Figure 3-8). This same decline in the density of riparian tree cover is also observed in historical aerial photographs from 1948, 1950, 1963, 1972, 1980, and 1987.

The decline in tree cover along Guadalupe Creek downstream from Camden Avenue coincides with a transition from the Santa Cruz Mountains to the Santa Clara Valley where geologic units change from weakly consolidated, Late Pleistocene alluvium to unconsolidated alluvium (Figure 3-2). The decline in tree cover could reflect these changes in geology, changes that may influence vegetation cover by their effect on subsurface groundwater flow and availability, soil characteristics, and regional topography.

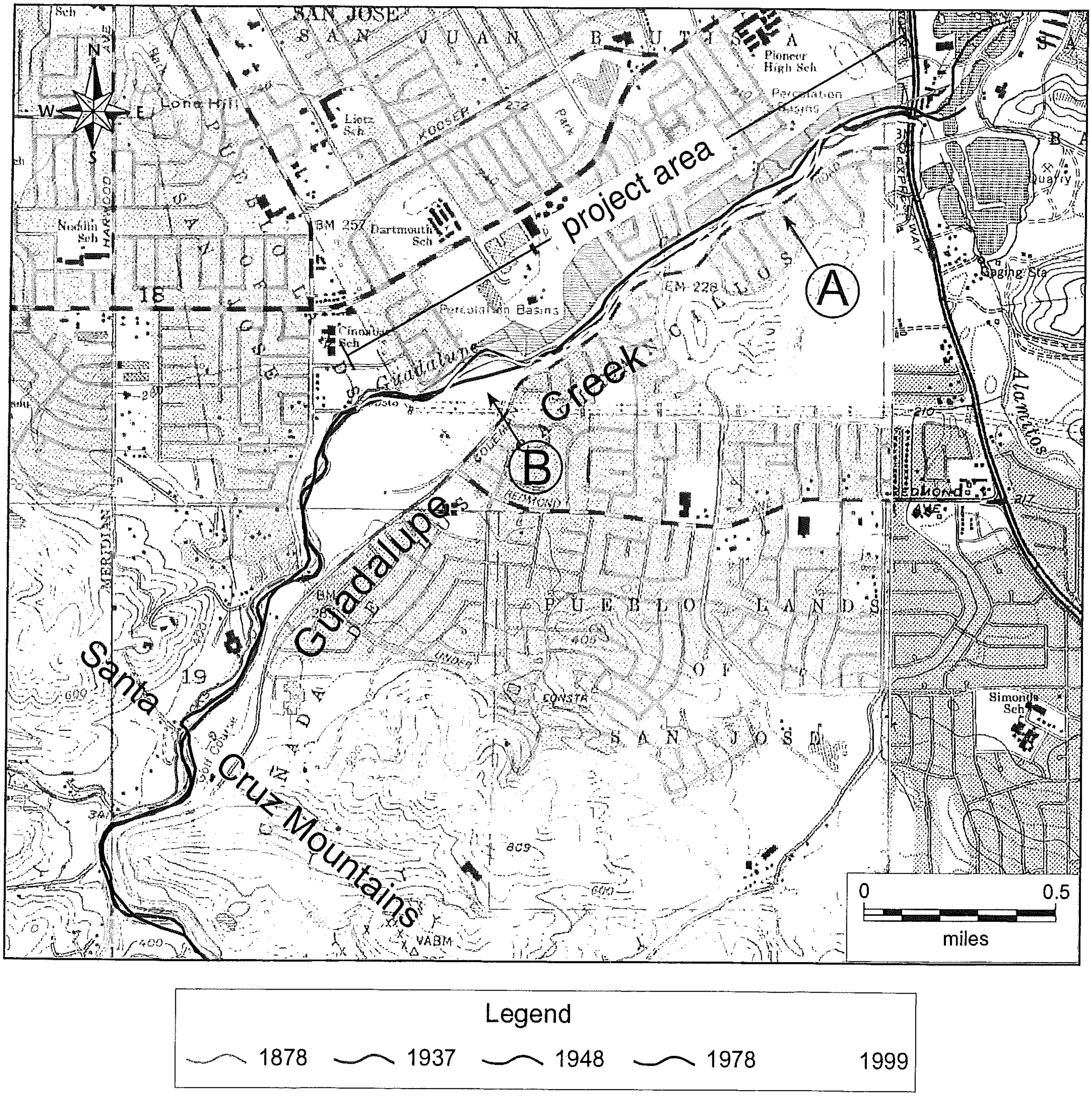
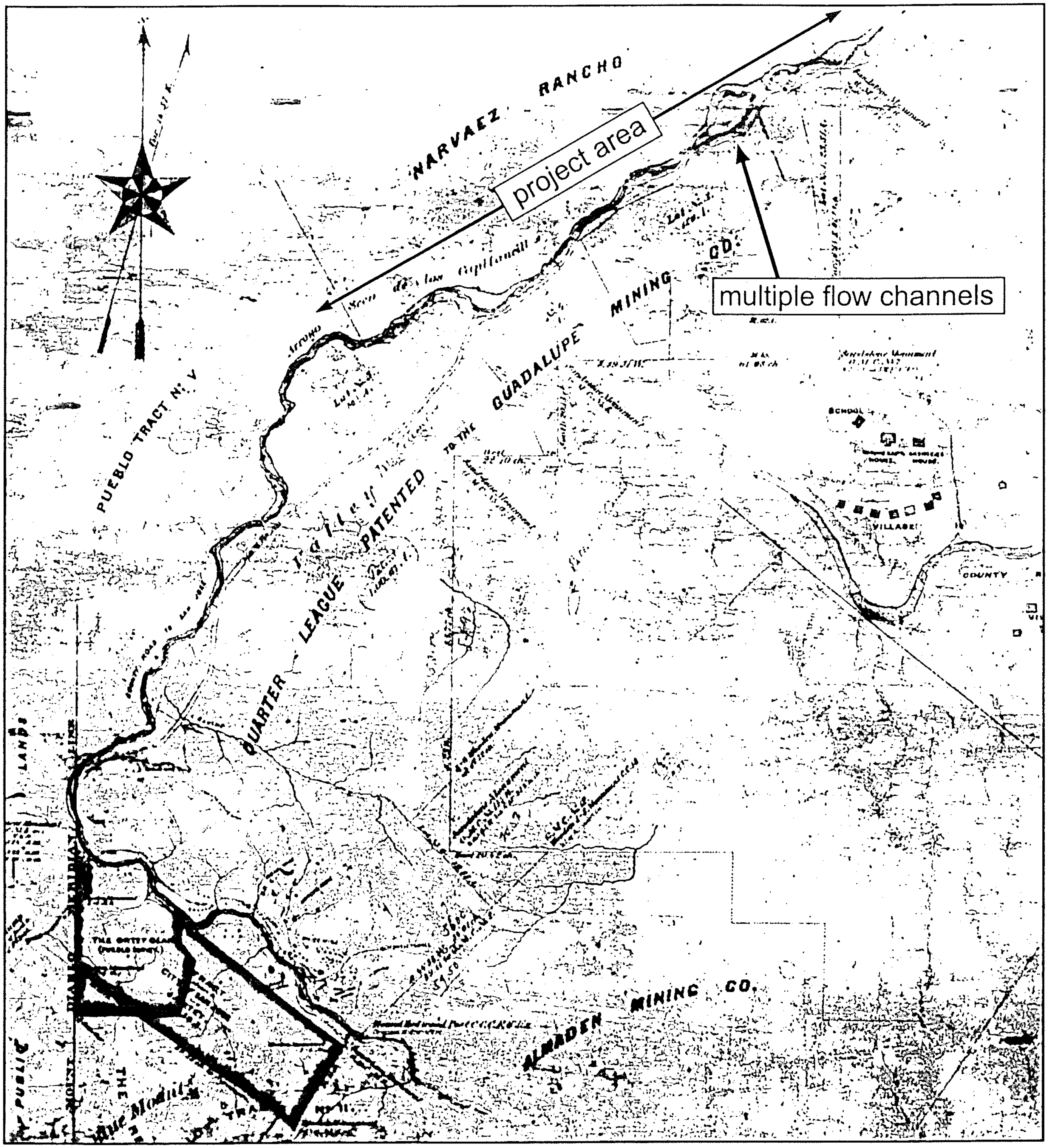


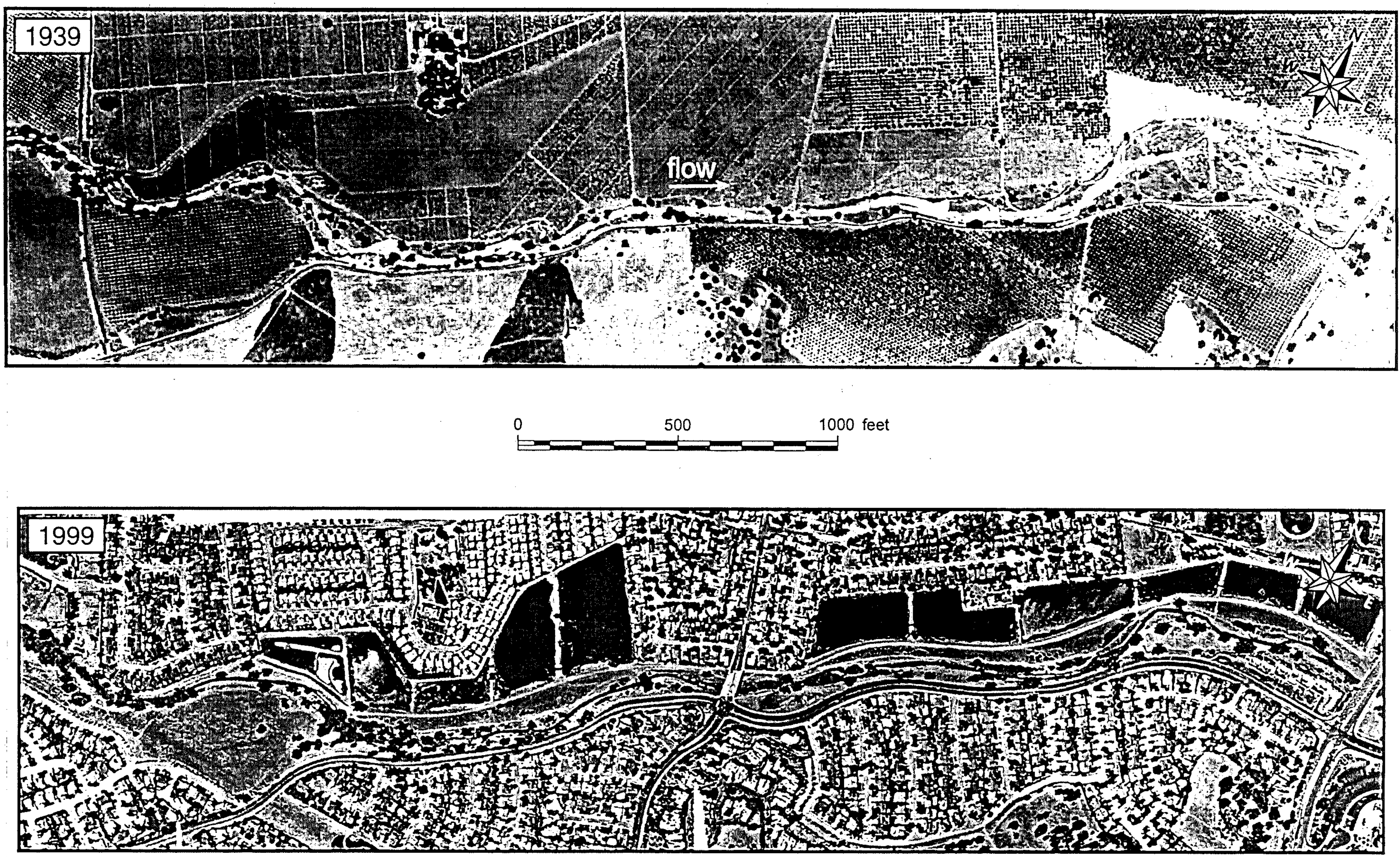
Figure 3-5
Planform Shift Map of Lower Guadalupe Creek



Not to Scale

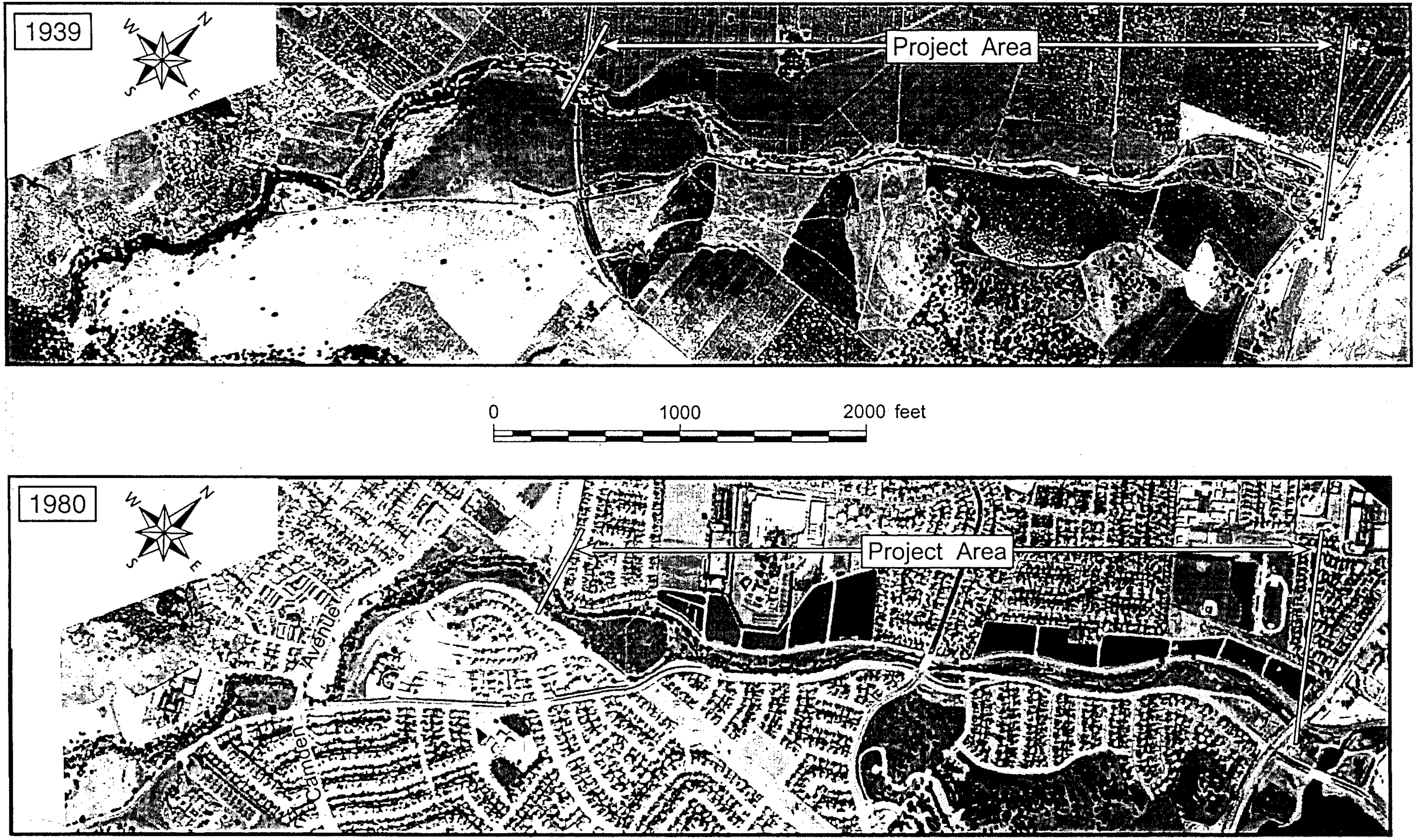
Jones & Stokes
nhc

Figure 3-6
Map Showing Multiple Flow Channels in 1871 Alignment of Guadalupe Creek



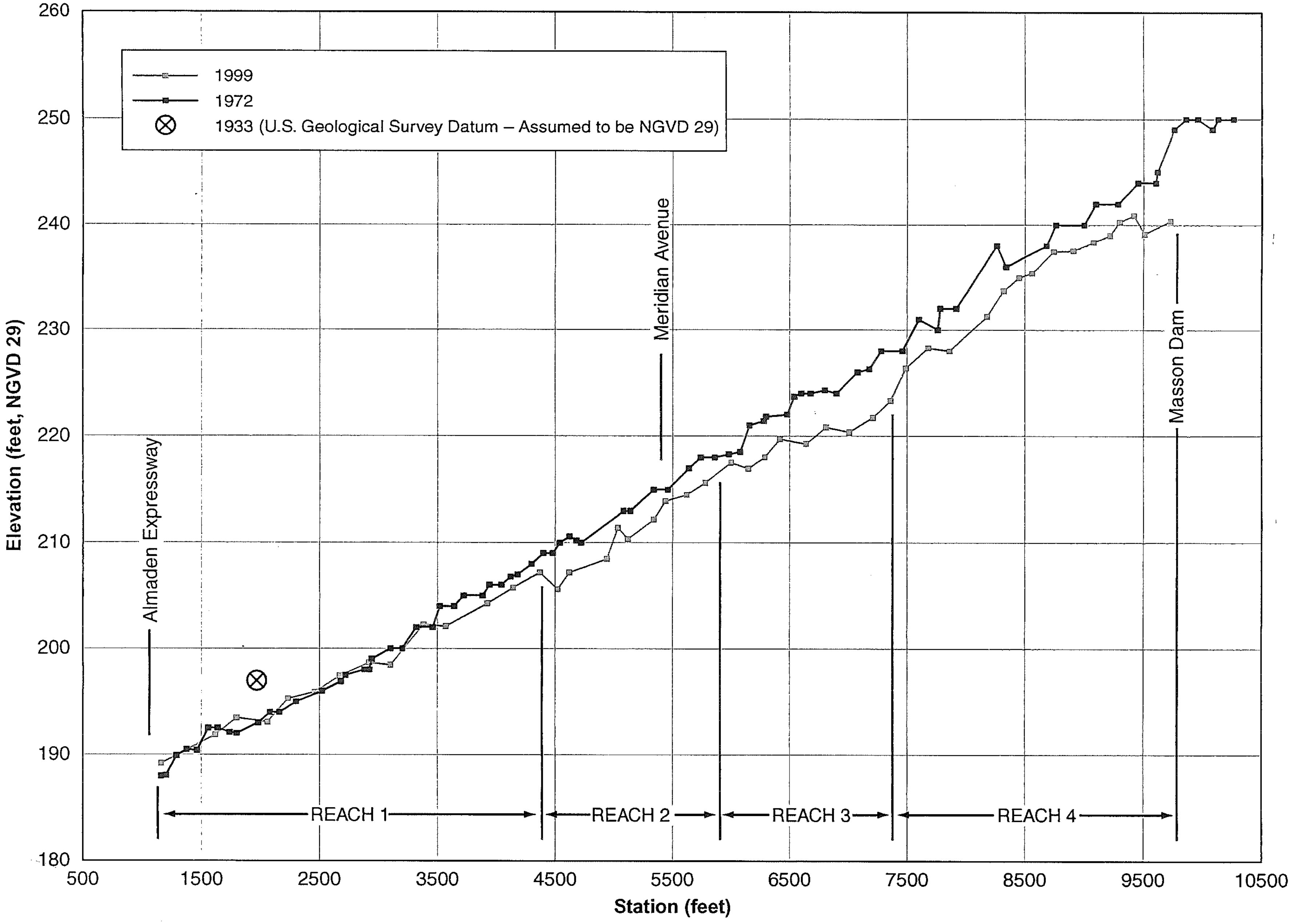
Jones & Stokes
nhc

Figure 3-7
Comparison of 1939 and 1999 Aerial Photographs of
Project Area on Lower Guadalupe Creek



Jones & Stokes
nhc

Figure 3-8
Comparison of 1939 and 1980 Aerial
Photographs of Lower Guadalupe Creek



Jones & Stokes
nhc

Figure 3-9
Channel Bed Profile Data of Project Reaches from 1933, 1972, and 1999

Historical 1953 U.S. Geological Survey (USGS) topographic maps show that lower Guadalupe Creek was once mined for gravel on the north bank at station 38+00 and off-channel on the north bank at station 46+00 (see Appendix B for station locations). Gravel mining in these locations was probably limited, as they are not well defined in historical aerial photographs. In addition, historical aerial photographs from 1939 to 1963 suggest that gravel mining may have occurred in a 1,500 foot section extending upstream from the Almaden Expressway. The affected area occupies the full channel width, including the area currently occupied by percolation ponds. The aerial photographs, however, do not clearly show whether the apparent disturbance was caused by mining or by some other form of disturbance, such as the creation of furrows for instream water percolation.

The 1933 plans for the construction of an instream percolation dam on Guadalupe Creek near Almaden Expressway show a narrow berm extending approximately 500 feet from the north bank across the mouth of Guadalupe Creek (Santa Clara Valley Water District 1933). Almaden Road is located on this berm and crosses the creek at a narrow bridge. Whether this berm was constructed or is a remnant of material left in situ by gravel mining is unclear. In either case, the bridge crossing in 1933 is approximately 110 feet wide. This width is comparable to the 120-foot wide opening observed at the Almaden Expressway Bridge today, though most of the Guadalupe Creek side of this berm is now bordered by percolation ponds.

Aerial photographs from 1939, 1948, 1950, and 1963 show instream gravel mining on Guadalupe River and on Alamitos Creek, ranging from approximately 2,500 feet upstream to approximately 2,500 feet downstream from the Guadalupe Creek confluence. Subsequent years (1980 and 1987) show the gravel pits on Alamitos Creek and Guadalupe River largely filled with water, appearing as a sequence of ponds with the largest on Alamitos Creek just upstream from the Guadalupe Creek confluence. This area is now occupied by Almaden Lake, and is presently used for summer recreation purposes.

Another significant feature observed in historical aerial photographs of the project area is a line of vegetation that intersects Guadalupe Creek in the middle of a gradual bend at station 80+00 (Appendix B). This feature is difficult to see in the 1999 aerial photographs but is clearly evident by a line of shrubs and trees in the 1939 photographs (Figure 3-7). This irregular line of vegetation is also observed in the 1948, 1950, and 1963 aerial photographs. Its proximity to the creek channel suggests this feature may mark the location of a paleochannel or an irrigation ditch now overgrown with vegetation. The line of vegetation is located along the base of a slope between a higher terrace level and the terrace surface adjacent to Guadalupe Creek; therefore, it is also possible that vegetation is concentrated along this area due to increased groundwater availability along the toe of the slope. Aerial photographs in 1999 show a relatively high concentration of trees on Guadalupe Creek at station 79+00. The wide channel bottom at this location and a possible increase in groundwater throughflow are likely contributors to the high density of tree cover in this area.

All historical aerial photographs show varying degrees of roads and tracks crossing through Guadalupe Creek, particularly in the downstream part of the project area. In general, aerial photographs from 1939 to 1970 show significantly greater disturbance than in later years. Large-scale disturbance of the creek channel is observed as late as 1970, where aerial photographs from as-built plans of the 1972 flood corridor expansion show a gravel haul road graded along the creek bed from Almaden Expressway to station 42+40 (Appendix B). Upstream from this location, the natural creek channel is evident and the creek bed appears less disturbed.

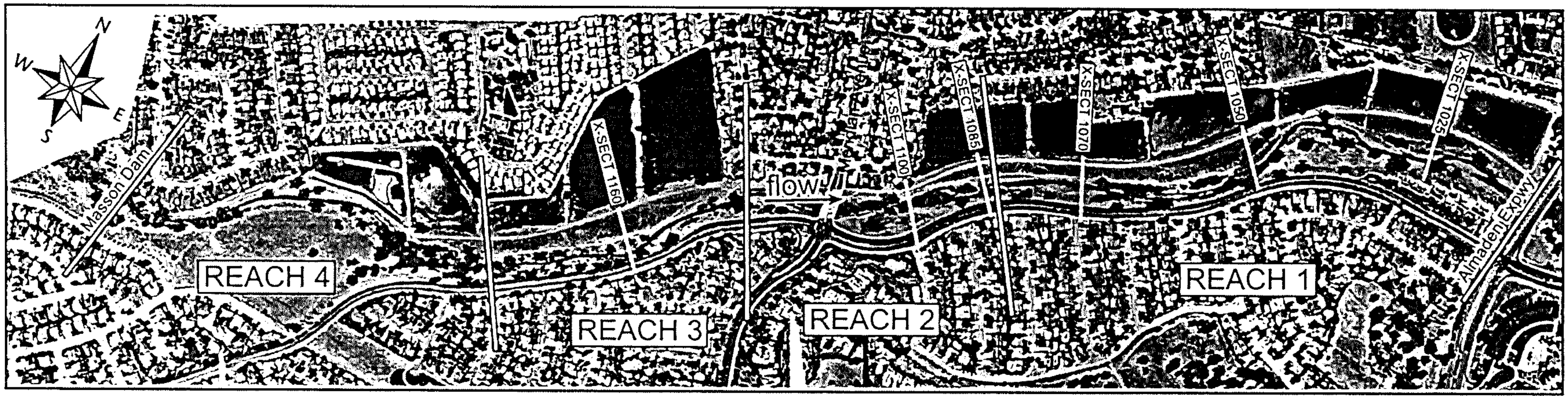
Historical Channel Bed Profile and Cross Sections. Historical channel bed profile data were available for the project area from the 1972 District as-built plans. An additional data point from a 1933 cross section approximately 800 feet upstream from Almaden Expressway was also available (Santa Clara Valley Water District 1933). General plans for the 1964 percolation pond construction were available from the District but as-built plans for both the 1962 and 1964 pond construction were not. The available data are compared with 1999 bed profile data collected by NHC (Figure 3-9). Examination of Figure 3-9 indicates that the Guadalupe Creek bed degraded approximately 4 feet from the 1933 to 1972 bed elevation at station 19+70. In contrast, most of Reach 1 appears stable from 1972 to 1999, but there is a clear trend of channel degradation observed upstream. The amount of bed degradation is generally greater in Reaches 3 and 4, increasing to as much as 9.0 feet downstream from Masson Dam. Reach 1 shows 0–2 feet of degradation, whereas Reaches 2, 3, and 4 show 1.0–4.5 feet, 1.5–5 feet, and 1.5–9.0 feet of degradation, respectively.

In addition to a channel bed profile, 1972 as-built plans also contain pre- and postconstruction cross-section data (Santa Clara Valley Water District 1972). A total of six cross sections from 1972 as-built plans were located within 20 feet of 1999 cross-section locations, allowing for a direct comparison between the two data sets. The locations of these cross sections in the project area are shown in Figure 3-10. Cross-section comparisons are shown in Figures 3-11 through 3-16. Three sections are located in Reach 1, two in Reach 2, and one in Reach 3. No cross sections were available for comparison in Reach 4. Station numbers shown for the District cross sections in Figures 3-11 through 3-16 are based on stationing in 1972 District as-built plans (Santa Clara Valley Water District 1972).

Examination of pre- and postconstruction cross sections in Figures 3-11 through 3-16 clearly reveals the large changes made during the 1972 flood corridor expansion. Postconstruction cross sections show an increase in top width of the flood corridor by more than 100% in some locations (Figures 3-12 and 3-16). It is also clear where areas were cut and filled along the newly constructed flood corridor to create a broad floodplain bench on the north bank.

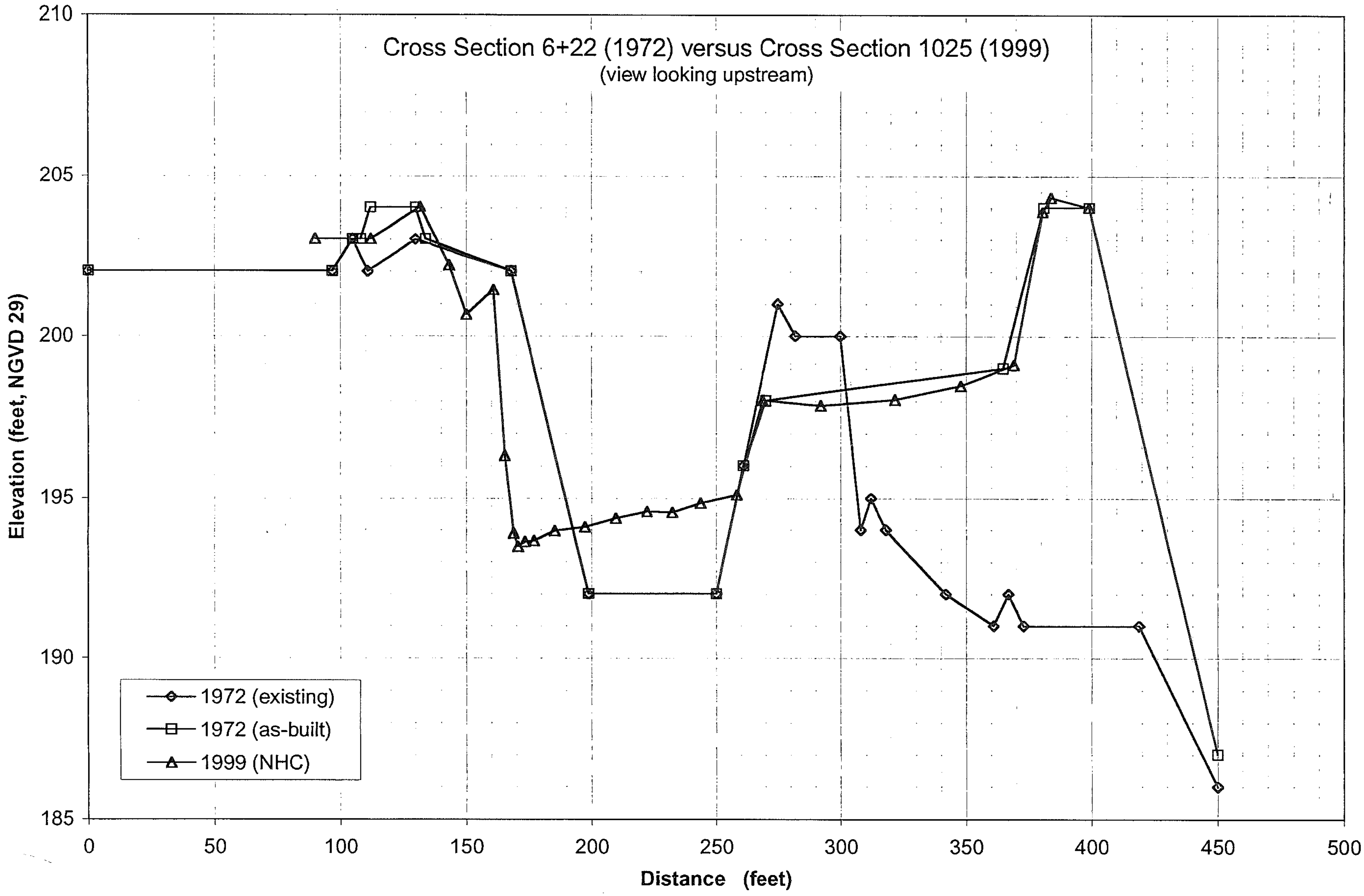
Comparison of pre- and postconstruction surveys show that the creek channel was not changed during construction of the expanded flood corridor; however, the channel bed appears remarkably flat in three of the six cross sections (Figures 3-11, 3-13, and 3-15), suggesting that either the surveyor did not map the channel bed or that there was no well-defined creek channel. If the latter is true, it suggests some form of channel disturbance, such as excavation, filling, or grading prior to the preconstruction surveys. This channel disturbance may have been caused by the construction of a haul road, observed in 1970 aerial photographs in the 1972 as-built plans (District 1972). If so, this disturbance would account for the lack of a well-defined creek channel in the preconstruction surveys.

Comparison of 1972 and 1999 cross sections shows incision of the creek channel in the four upstream-most cross sections (Figures 3-13 through 3-16), reflecting the bed degradation that has



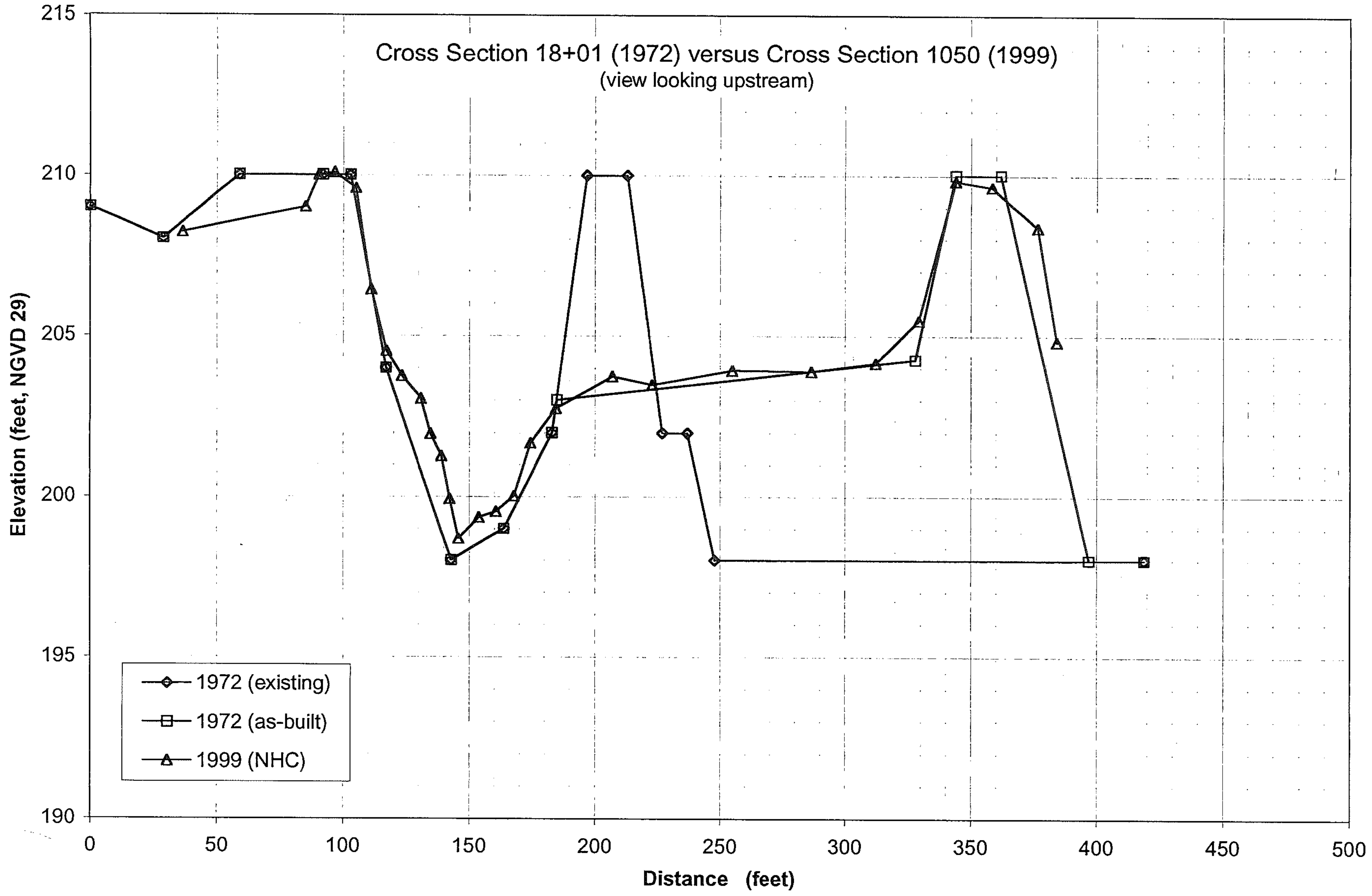
Note: "X-SECT" = Cross section

Figure 3-10
Station Locations of 1972 and 1999 Cross Section Comparisons



Jones & Stokes
nhc

Figure 3-11
Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 18+00



Jones & Stokes
nhc

Figure 3-12
Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 29+20

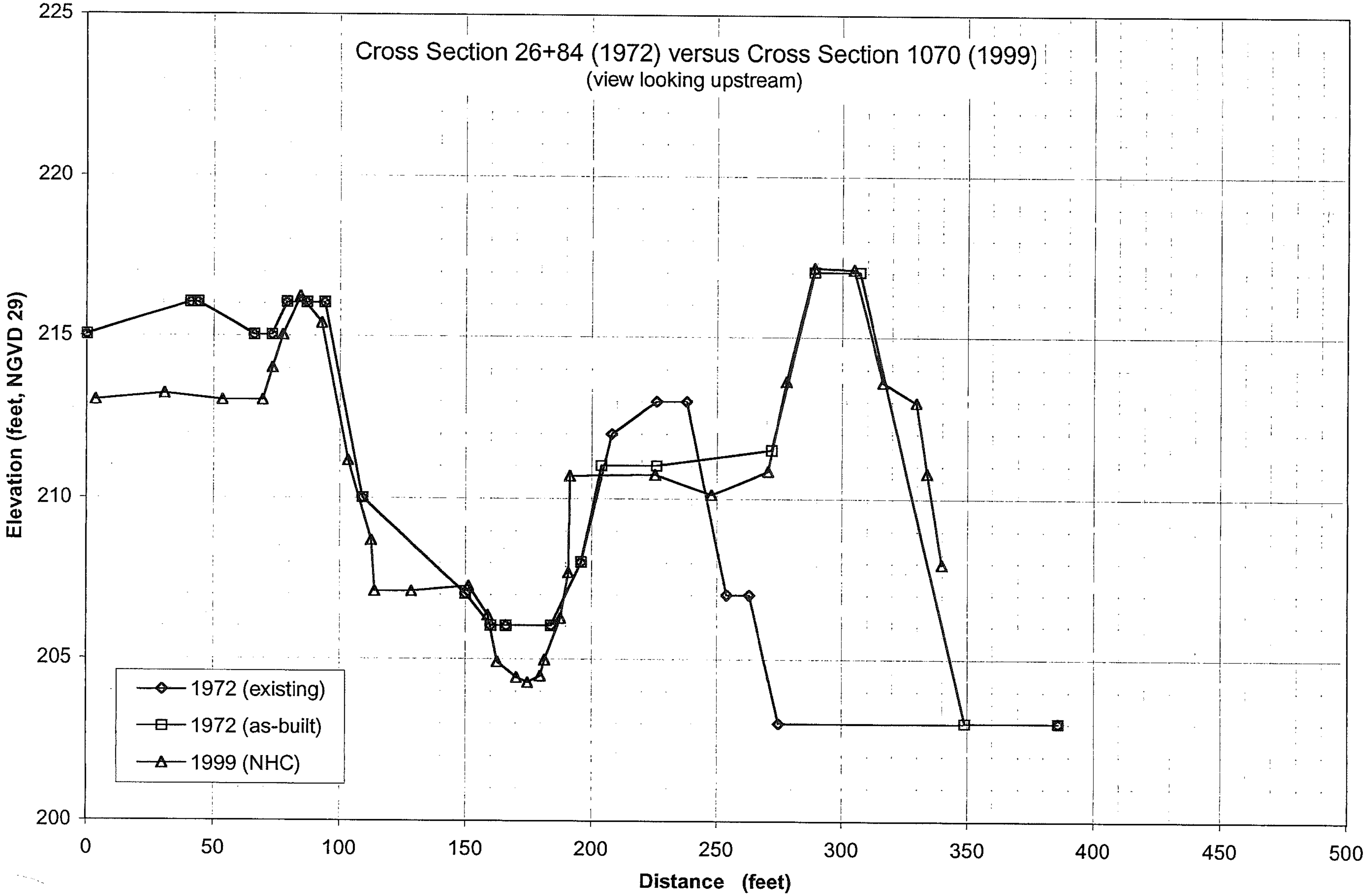
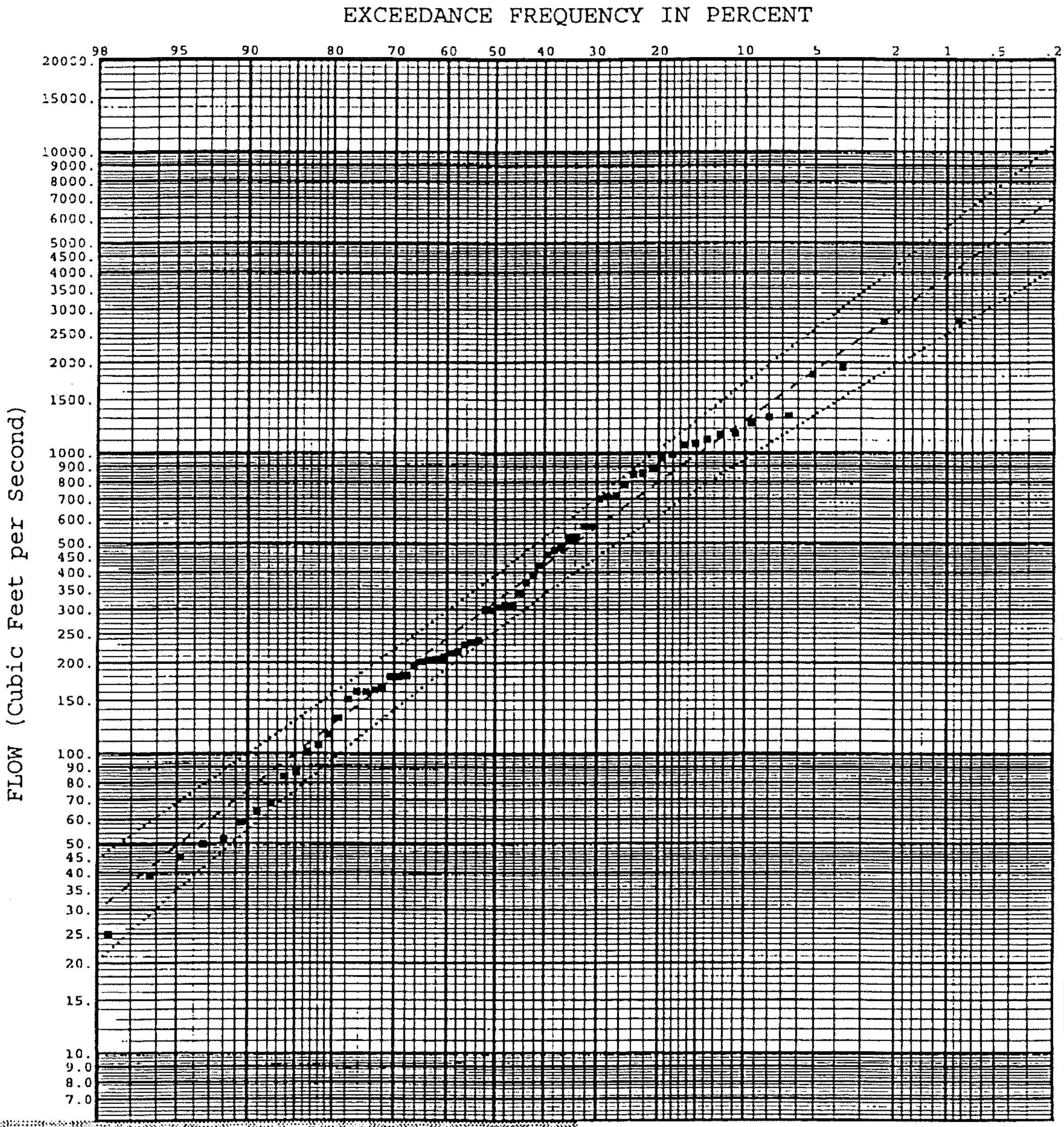


Figure 3-13
Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 39+20

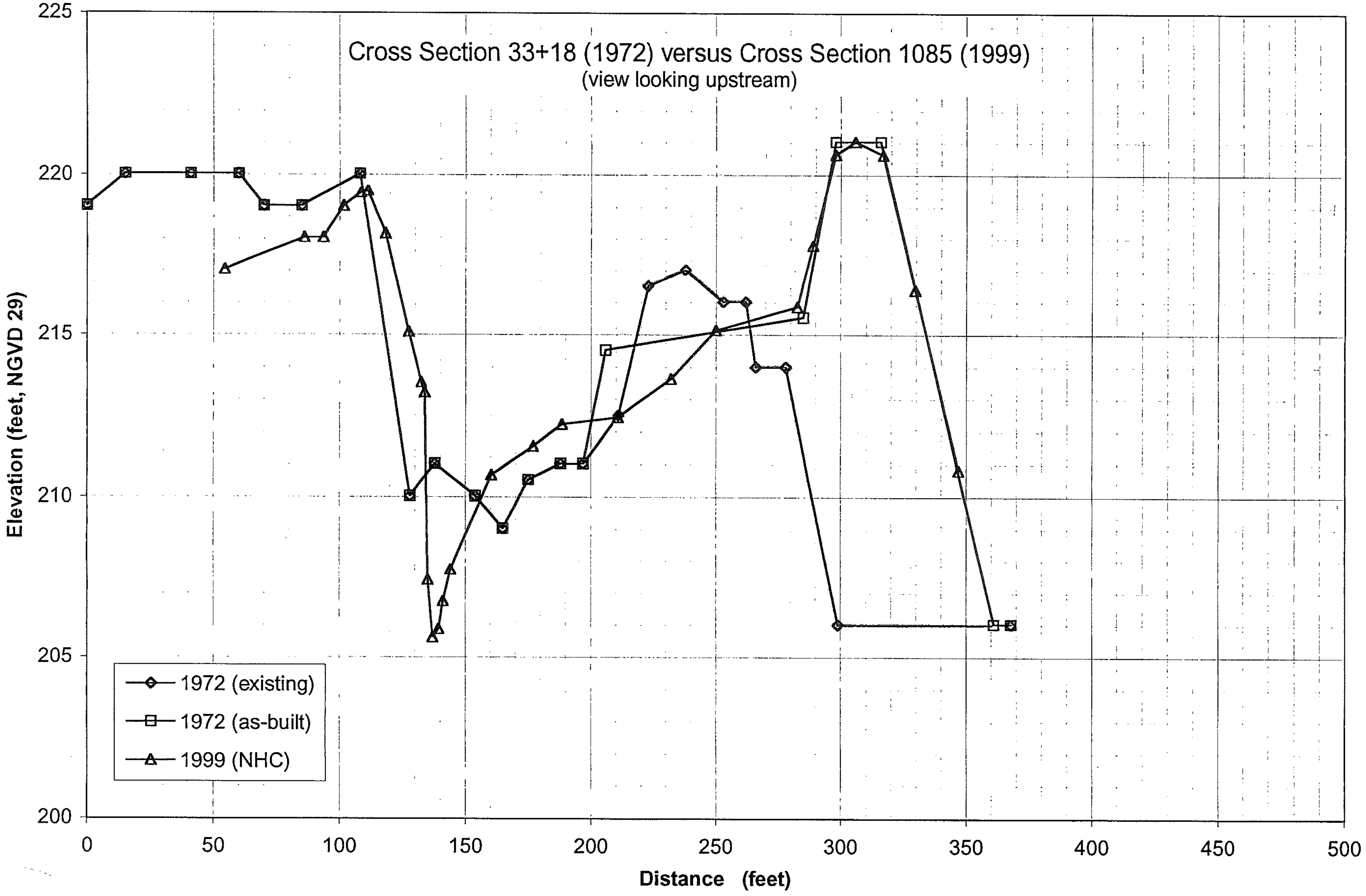


- - - Flow Frequency (with Expected Probability)
■ User-Defined Positions
······· 5% and 95% Confidence Limits

FREQUENCY STATISTICS LOG TRANSFORM OF FLOW, CFS		NUMBER OF EVENTS	
MEAN	2.4960	HISTORIC EVENTS	0
STANDARD DEV	.4715	HIGH OUTLIERS	0
SKEW	-.0957	LOW OUTLIERS	1
REGIONAL MAP SKEW	--	ZERO OR MISSING	0
ADOPTED SKEW	-.1000	SYSTEMATIC EVENTS	70

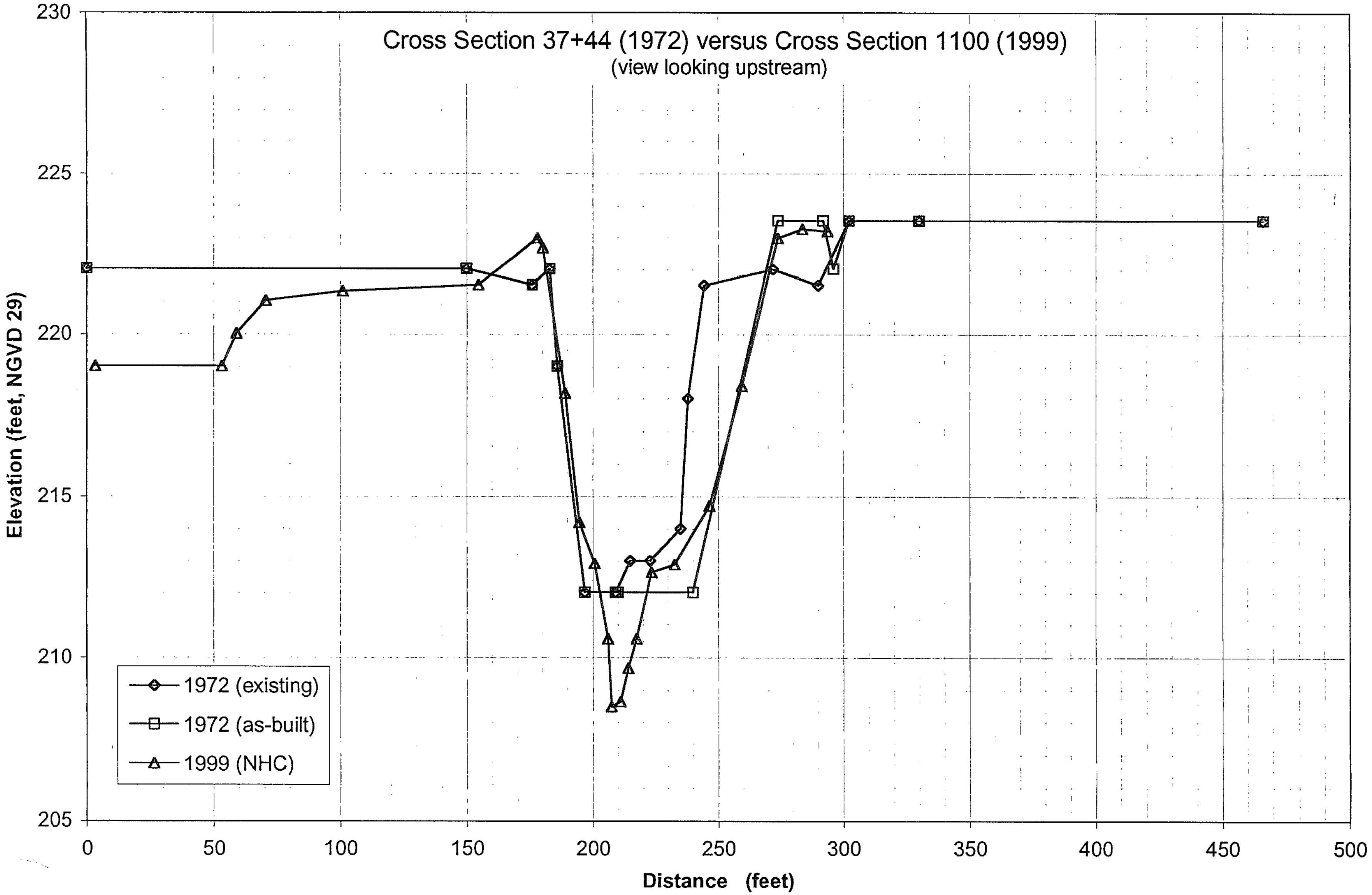
GUADALUPE CREEK
AT GUADALUPE, CA
BASIN AREA = 12.8 Square Miles

Figure 3-19
Annual Flow Frequency Curve for Streamflow Gage 43



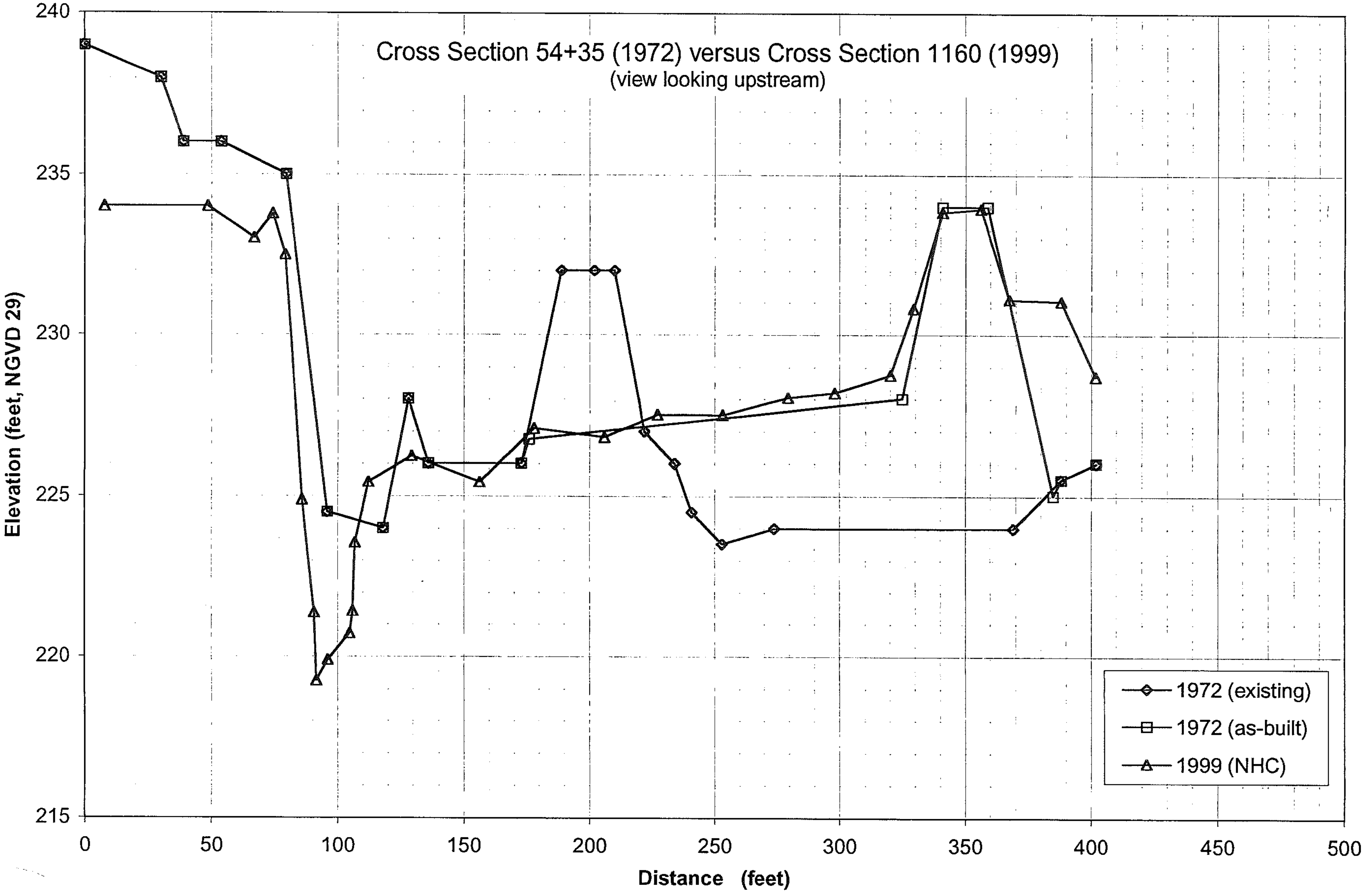
Jones & Stokes
nhc

Figure 3-14
Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 45+20



Jones & Stokes
nhc

Figure 3-15
Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 49+40



Jones & Stokes
nhc

Figure 3-16
Comparison of 1972 and 1999 Surveyed Cross Sections on Guadalupe Creek at Station 66+40

occurred over time. Channel incision is restricted to the 20- to 30-foot width of the creek channel. As a result, the creek channel is significantly more entrenched in 1999 cross sections when compared to 1972 cross sections (Figures 3-13 through 3-16).

3.1.1.5 Historical and Future Trends

This portion of the report summarizes historical and ongoing trends in the evolution of lower Guadalupe Creek. Based on the available information, likely future trends in creek evolution are identified.

Historical Trends. Key historical changes that have likely affected channel planform, cross-section, and bed profile through time include channel confinement; gravel mining; levee, bridge, and dam construction; in-channel modifications; and changes in basin hydrology caused by the construction of Guadalupe Dam. In addition, ongoing geologic processes and Holocene climate change may also have caused historical stream adjustment but are much more difficult to quantify. Given that many of these changes occurred during the same or overlapping time periods, it is impossible to distinguish the extent to which each activity affected river morphology. Nonetheless, stream response to specific events, such as instream gravel mining, dam construction, 1962 flood-corridor construction, and 1972 flood corridor expansion, can be identified qualitatively based on current understanding of river geomorphology and hydraulics.

The link between instream gravel mining and stream degradation is well understood (Collins and Dunne 1990). Instream gravel mining on Guadalupe River immediately downstream from Guadalupe Creek began sometime before 1939. Less significant gravel mining also occurred on portions of Guadalupe Creek but probably ended in the early 1960s when a series of percolation ponds was installed along the north bank of the creek. Although specific quantities of gravel extracted are unknown, it is likely that these mining activities, in addition to those on Alamitos Creek, contributed to the 4 feet of channel degradation observed from 1933 to 1972 (Figure 3-9). In contrast, there is little or no change in bed elevation in the lower part of the project area from 1972 to 1999, indicating that continued mining in Guadalupe River did not cause additional stream degradation on Guadalupe Creek during this period.

The construction of Guadalupe Dam in 1935 resulted in changes to basin hydrology and sediment yield by trapping both water and sediment from the upper Guadalupe Creek watershed. Typically, streams scour and degrade downstream from dams following their construction because flow releases contain little or no sediment in the size classes found in the stream bed. These flows are sometimes referred to as "sediment-hungry". Degradation normally declines with distance downstream from the dam as well as over time. Ultimately, after several larger floodflows, the channel may become armored and increasingly resistant to further degradation, resulting in a new channel equilibrium.

The bed profile from 1972 to 1999 in Figure 3-9 shows a trend toward decreasing channel degradation with distance downstream from Masson Dam. In addition to dam construction, factors that may have contributed to greater channel incision in the vicinity of Masson Dam and in Reach

4 include an historical realignment of the channel sometime between 1948 and 1978 (Site B in Figure 3-5), the addition of revetment along the left bank from about station 81+00 to station 83+00, and a higher sediment transport capacity in Reach 4 than in downstream reaches. The construction of Masson Dam, probably sometime between 1962 and 1964, may have induced downstream bed degradation in a manner similar to Guadalupe Dam, though on a much smaller scale. Channel bed material exhibits large clast sizes in the upper part of Reach 4, which is consistent with armoring of the channel bed caused by stream degradation. However, Reach 4 is also steeper and exhibits a more confined channel cross section, factors which could also contribute the higher clast sizes observed in Reach 4. Examination of 1972 District as-built plans shows that the channel realignment observed at Site B in Figure 3-5 occurred sometime before 1970. This realigned section, as well as channel bank revetment downstream, could also have contributed to channel degradation because the channel was shortened, straightened, and confined, making it more likely to scour in high flows. Channel realignment also appears to have included the formation of two intermediate-level benches, the only ones in Reach 4, both of which have been previously planted by the District in Phase 1 of the Guadalupe Creek Restoration Project (station 86+00 to 90+00).

The construction of a levee and percolation ponds along Guadalupe Creek in the early 1960s resulted in the constriction of creek flows to a narrow flood corridor. Limited by the width of the flood corridor, high flows were no longer able to spread out onto the historic floodplain. Confinement of channel flows would result in higher shear stresses on the channel bed and banks during high flows, promoting scour and stream bed degradation.

The District flood control project in 1972 greatly altered the geometry of the flood corridor as well as the creek channel. 1970 aerial photographs show that the creek channel was nonexistent from Almaden Expressway to station 42+40 during initial phases of the project. Instead, a gravel haul road appears in its place. Whether this road was extended further upstream by the end of construction in 1972 is unknown. Examination of all cross-section data from 1972 as-built plans shows that, of the 69 cross sections in the project area (station 11+00 to station 80+00), 40 show a nearly flat channel bed in the base of the cross section. This finding indicates that the creek channel was poorly defined along most of the project area, either due to surveying techniques or due to significant disturbance of the creek channel during construction. Thus, some of the observed bed profile degradation in Figure 3-9 may be due to surveying methods or the natural formation of a creek channel following construction activities.

Future Trends. Given the historical stability in channel planform (Figure 3-5), generally straight alignment, and low sinuosity of Guadalupe Creek within the project area, future channel planform shift is expected to continue to occur at a very slow rate. Planform shift will occur along existing areas of bank erosion in the project area. Bank erosion will be an important concern in areas where the creek is eroding immediately adjacent to existing infrastructure, such as Coleman Road (station 32+00). Higher rates of bank erosion are expected in meander bends that exhibit ongoing erosion of the outer bank, with concurrent gravel bar deposition on the inner bank. The sharp bend at station 47+00 downstream from Meridian Avenue is an example of this type of active meander bend in the project area.

Historical bed degradation on lower Guadalupe Creek since 1972 has been greatest immediately downstream from Masson Dam (Figure 3-9). In contrast, no instream degradation is observed in the lower part of Reach 1 near Almaden Expressway during this period. Gravel bar accumulation in Reach 1 and bed profile stability since at least 1972 indicate that, barring significant changes to channel geometry or hydrology, the bed elevation in Reach 1 will remain stable in the future. The greatest potential for channel degradation is found in Reach 4, for reasons described in Historical Trends. In addition, the 1999 removal and reconstruction of Masson Dam could initiate a future phase of channel incision in Reach 4, adding to the existing trend of channel bed decline (Figure 3-9). Channel adjustment would be greatest during the years immediately following dam construction, receding as channel conditions reached a new equilibrium. In addition, Masson Dam has acted as a bed control, preventing stream degradation observed in 1972–1999 from progressing further upstream. Removal of the dam in 1999 may have initiated knickpoint migration and channel incision that has now progressed upstream from the new Masson Dam site.

Examination of historical aerial photographs from 1939 to present shows that there has been little change in the amount of aerial vegetation along the project area. Similarly, the density and continuity of tree cover along the riparian zone have remained relatively constant for the historical period. In the absence of the restoration project, future patterns in natural tree and vegetation cover would not be expected to change.

In general, any future instream channel modifications in the project area, or in some locations downstream, will have an effect on overall stream morphology. Similarly, changes in basin hydrology and water management may result in channel adjustment.

3.1.1.6 Summary and Conclusions

The following conclusions summarize the findings of this geomorphic investigation:

- The project area can be divided into four geomorphic reaches:
    - Reach 1: Downstream reach dominated by large, alternating gravel bars,
    - Reach 2: Transition reach where channel narrows through Meridian Avenue Bridge,
    - Reach 3: Wide channel reach with large left bank bench, and
    - Reach 4: Confined, narrow reach with steep high banks.
- The project area shows a decline in the channel bed of between 0 and 9.0 feet for the period 1933 to 1999. Key historical changes that have likely affected channel planform, cross section, and bed profile through time include channel confinement; gravel mining, levee, bridge, and dam construction; in-channel modifications; and changes in basin hydrology. However, given that many of these changes occurred during the same or overlapping time periods, it is impossible to distinguish the extent to which each change actively affected river morphology.

- Historical information and current sediment transport capacity analyses show that the higher potential for future channel degradation can be expected in Reach 4, whereas no future degradation is expected in Reach 1.

- Channel planform has remained very consistent since 1948 No major channel avulsions have occurred and no large-scale meander bend migration was observed. Future changes in channel planform are expected to occur very slowly. Thus, bank erosion will continue but at a slow to very slow rate.

- Examination of channel cross sections from pre-1972 and post-1972 District construction plans shows substantial changes in channel and floodplain geometry. Most important were:

    - Large increases in levee top width and flood capacity resulting from the reduction in size of percolation ponds and levee setback.

    - Substantial areas of cutting and filling, including the construction of wide benches in the Guadalupe Creek flood corridor.

- Historical aerial photographs from 1939 to 1999 show very little change in the appearance of the wooded riparian zone from Camden Avenue to Almaden Expressway. The consistent decline in the density and frequency of trees from Camden Avenue to Almaden Expressway has been present since at least 1939.

3.1.2 Hydrology

3.1.2.1 Hydrologic Setting

Guadalupe Creek is located in the southern portion of Santa Clara County in northern California (Figure 1-1). The drainage area extends from the headwaters in the Santa Cruz Mountains to the confluence with Alamitos Creek. Elevations within the basin range from 180 feet near the confluence with Alamitos Creek to 3,486 feet NGVD 1929 at the summit of Mt. Umunhum.

Climate. The project area has a Mediterranean type climate generally characterized by moist mild winters and dry summers. Summertime average maximum temperatures range from 79 to 82°F, and summertime average minimum temperatures range from 55 to 57 °F. Wintertime average maximum temperatures range from 58 to 62 °F, and wintertime average minimum temperatures range from 41 to 44 °F (Western Regional Climate Center 1999). The measurable precipitation is in the form of rainfall, 85% of which occurs between November and April. Mean annual precipitation ranges from a high of 40 inches near Mt. Umunhum to a low of 16 inches near the confluence of Guadalupe and Alamitos Creeks (Santa Clara Valley Water District 1994).

Watershed Characteristics. The Guadalupe Creek watershed (Figure 3-1) has a total drainage area of 15 square miles. The drainage basin transitions from the steep Santa Cruz Mountains, with slopes ranging from 10 to 75%, to a more mildly sloping alluvial fan. This transition occurs between Camden Avenue and the upstream limit of the project area at Masson Dam. Upstream from Camden Avenue, the basin is relatively undeveloped. Downstream from Camden Avenue, the basin is developed primarily in subdivisions of single and multiple family dwellings, with a correspondingly high percentage of impervious cover.

The portion of the watershed upstream from Camden Avenue has a drainage area of approximately 13 square miles. The geology of this portion of the watershed is predominantly Franciscan Complex with outcrops of serpentinized ultramafic rock. As discussed in Section 3.1, the Franciscan Complex is highly erodible and is susceptible to mass wasting processes. Soils within this region are a mix of Los Gatos and Maymen soils. The Los Gatos soil is characterized by gravelly loam with 50 to 75% slopes. The Maymen soil is comprised of rocky fine sandy loam with 50 to 75% slopes. Both soil types are extremely erodible (Soil Conservation Service 1968).

Within the upper portion of the drainage basin, Guadalupe Dam regulates approximately 6 square miles of the upper eastern portion of the drainage area. The tributaries upstream from the dam are Guadalupe, Los Capitancillos and Rincon Creeks. The tributaries downstream from the dam are Dresti, Reynolds, Pheasant, Arnerich, and Shannon Creeks.

The vegetation in the upper watershed consists mainly of hardwoods with an understory of brush, grasses, and forbs. The southwesterly facing slopes tend to be more densely vegetated, whereas the northeasterly slopes are vegetated with fewer trees and more grasses.

The project area begins at Almaden Expressway, approximately 500 feet upstream from the confluence of Guadalupe Creek and Alamitos Creek and extends upstream approximately 9,000 feet upstream to Masson Dam. This area is located in the lower-most portion of the Guadalupe Creek watershed.

Previous Studies. Hydrologic studies of the Guadalupe River watershed have been performed by the Corps and the District. The District conducted a hydrologic study to estimate peak flows and event volumes for flood facilities in Santa Clara Valley in 1978. In 1994, the District recomputed the 1978 flow frequency analysis for Guadalupe Creek by extending the data set to include measured annual streamflow peaks up to 1992. These results were compared with the results of the 1978 hydrologic analysis. The District concluded that the differences between frequency curves were insignificant (Santa Clara Valley Water District 1994). In 1973, the Corps estimated the 100-year peak flow (i.e., a flood that has a 1% chance of being equaled or exceeded in any one year) to delineate flood hazards along Guadalupe Creek (U.S. Army Corps of Engineers 1973). In 1977 the Corps estimated volume-frequency curves for Guadalupe Reservoir and peak flow frequency relationships for Guadalupe Creek at Guadalupe (SF 43) as part of a hydrologic study for the Guadalupe River and Coyote Creek watersheds (U.S. Army Corps of Engineers 1977).

Available Data. The District operates two streamflow gages on Guadalupe Creek and one within the Los Capitancillos percolation pond system. Figure 3-1 shows the approximate locations of the streamflow gages in the watershed. Streamflow gage 17 (SF 17), located near the base of the dam, measures flows on Guadalupe Creek downstream from Guadalupe Reservoir. Streamflows have been recorded at this gage since 1960. SF 43, operated from 1930 to 1959 by the USGS and from 1960 to present by the District, is located approximately 0.5 miles upstream from Camden Avenue. Dresi, Reynolds, Pheasant, Arnerich, and Shannon Creeks provide seasonal flows into Guadalupe Creek between SF 43 and the reservoir. The District operates SF 46 at the outlet of the most upstream pond in the Los Capitancillos perculation pond system. Data from this gage are used to estimate the monthly water balance within the Guadalupe distribution system. A summary of the District gage stations is listed in Table 3-4.

In the fall of 1995, the District began collecting hourly water temperature data in Guadalupe Creek at five locations. Temperature gaging stations near SF 17, SF 43, downstream from Masson Dam, and near Almaden Expressway are monitored from late spring to late fall. An additional station upstream from Masson Dam is installed and monitored on a periodic basis.

Water quality data was collected by the USGS on a periodic basis from 1980 to 1991 at SF 43. No measurements of suspended sediment or bedload have been performed on Guadalupe Creek.

Table 3-4. Inventory of Streamflow Gage Data for Guadalupe Creek

Streamflow Gage	Period of Record	Measured Data
17	1960–1990	Maximum and minimum daily stage Maximum and minimum daily discharge Mean daily discharge Daily volume
17	1991–1998	Mean daily discharge
43	1930–1959	Annual peak discharge Mean daily discharge
43	1960–1990	Maximum and minimum daily stage Maximum and minimum daily discharge Mean daily discharge Daily volume
43	1991–1999	Annual peak discharge Mean daily discharge
46	1965–1995	Maximum and minimum daily stage Maximum and minimum daily discharge Mean daily discharge Daily volume
46	1996–1998	Mean daily discharge

Water Management. Guadalupe Reservoir captures flows from Guadalupe, Los Capitancillos, and Rincon Creeks. The reservoir was completed in 1935 as a water supply storage facility and provides ancillary flood control benefits. The reservoir has a total capacity of 3,728 acre feet. Under the Local Cooperation Agreement (LCA) between the Corps and the District, reservoir carry-over volumes for the Guadalupe Creek watershed were established to provide flood storage capacity. Carry-over volumes are measured on December 1. A maximum historic carry-over volume of 2,350 acre feet is prescribed for the Guadalupe Reservoir (Santa Clara Valley Water District 1999). This volume represents 73% of the total reservoir storage capacity. The reservoir has a dead pool storage of 67 acre feet and an additional 500 acre feet is reserved as a fish pool. The working pool storage for water supply and flood control is 3,228 acre feet. The Guadalupe Reservoir capacity is regulated as part of the LCA to provide flood control for the Guadalupe River. The District uses a combined storage rule curve to regulate outflows from several reservoirs, including Guadalupe Reservoir, that are tributary to the Guadalupe River. At stages below the spillway crest, flows are regulated at the Guadalupe Dam through a 36-inch-diameter pipe. The maximum flow through the outlet orifice is 235 cubic feet per second (cfs).

The Guadalupe Creek watershed serves as a significant source of water for Santa Clara County. The District manages the water produced from the basin for water supply and flood control purposes. Figure 3-17 shows a schematic of the Guadalupe Creek water distribution system. The District maintains water rights and licenses that allow for the diversion of a maximum of 4,052 acre feet per year from Guadalupe Creek. Between December 1 and April 30, the District may divert 3,500 acre feet at Guadalupe Dam. A second license allows the District to divert 0.77 cfs from October 1 to May 1 from Guadalupe Creek. In addition, the District can divert 323 acre feet of local runoff between October 1 and May 1 at Masson Dam. These diversions are subject to Department of Fish and Game Code 5937, which requires the District to maintain flows for fish habitat (Aguilera 2000).

The reservoir is operated primarily to provide flows for groundwater recharge in the Los Capitancillos percolation ponds and in the bed of Guadalupe Creek in the project area. Upstream from the project area, Masson Dam is used to regulate the diversion of flows from the creek into the percolation ponds. Flashboards at Masson Dam are removed during the flood season if Guadalupe Reservoir reaches capacity. The flashboards are reinstalled in April at the end of the flood season. Water can be imported to and exported from Guadalupe Creek through the Almaden Valley pipeline. Imported water from the Almaden Valley pipeline, if available, can provide an additional source of water to the percolation ponds and the creek. Flows from the pipeline can be imported into Guadalupe Creek at Masson Dam. Masson Dam is currently being reconstructed to incorporate a fish ladder for fish passage, and the main dam structure has been removed from the creek.

The Los Capitancillos percolation ponds are supplied by water from Guadalupe Creek and the Almaden Valley pipeline. Flows diverted from the Almaden Valley pipeline to the Guadalupe Creek water distribution system are regulated and measured at Turnout 14 (Figure 3-17). The flow from the pipeline can be diverted to the percolation ponds or Guadalupe Creek at the junction box near the outlet of the turnout. Conversely, Guadalupe Creek flows can be diverted from the creek to the ponds at Masson Dam. Flow diversions to and from the creek at Masson Dam are not gaged and are estimated by maintenance and operations personal on a daily basis (Aguilera pers. comm.).

These estimates are reviewed to estimate mean monthly diversion volumes and water balance within the distribution system.

3.1.2.2 Flow Frequency

The probability of a specified peak flow occurring in any given year can be calculated by applying statistical methods to measured annual peak flows to produce a flow frequency relationship. A flow frequency analysis was performed to develop design flows for the Guadalupe Creek Restoration Project. These flow estimates were developed solely for use in this project and are not intended to revise previous estimates for flood control or water supply purposes. Peak flows for the 1.5-, 2-, 5-, 10-, 50-, and 100-year flood events were calculated for use in the preproject hydraulic model. Additionally, these flow estimates will be used in the project hydraulic models to evaluate and design postproject hydraulic characteristics.

Annual peak flow data measured at SF 43 for water years 1930 to 1999 were used to estimate a flow frequency relationship for Guadalupe Creek. A histogram of the annual peak flows is shown in Figure 3-18. The peak flow of record was 2,770 cfs and occurred on March 10, 1995. The minimum annual peak flow of 7 cfs occurred March 15, 1977.

The frequency analysis was performed using the Corps Hydrologic Engineering Center (HEC)-FFA software package (HEC 1992). The software is a modified application of the procedures prescribed in the Guidelines for Determining Flood Flow Frequency (U.S. Geological Survey 1982). A log-Pearson Type III probability distribution is fitted to the data. The length of the systematic record, 70 years, is one of the longest continuously operated streamflow gages in the area. The sample size is of sufficient length to assume that application of a regional skew would not improve the estimates compared to use of the computed skew from the period of record. The data was plotted using a general formula for computing plotting positions as described in USGS Bulletin 17B (U.S. Geological Survey 1982). Constants A and B in the general formula were set equal to 0.4 as recommended by Cunnane (1978). The plotting position formula is used to plot the data graphically but does not affect the computation of the flow frequency relationship.

The flow frequency analysis was not adjusted to account for the effect of Guadalupe Reservoir on peak flows. The reservoir regulates approximately 6 of the 12.8 square miles tributary to SF 43. The storage capacity of the reservoir will attenuate flood peaks, through the reservoir to varying degrees, depending on reservoir storage prior to the event. The District used an initial reservoir storage volume prior to the 1% design flood of 2,900 acre feet. This volume is approximately 90% of the working reservoir storage. As stated by the District, "Since the storage capacity of the reservoir is relatively small, it was assumed to have minor effect on the peak flows at the gage" (Santa Clara Valley Water District 1994). The flow frequency curve developed from annual peak flow data at SF 43includes the effects of reservoir regulation over the 65-year period that the reservoir has been in place. For the purposes of this project, the effect of the reservoir on nonrandomness of the data is considered insignificant. Application of the flow frequency relationship from SF 43 provides an effective and reasonably accurate means to update existing frequency estimates for a full range of flood flows. However, its application outside of this project is not recommended without consideration of the uncertainties involved

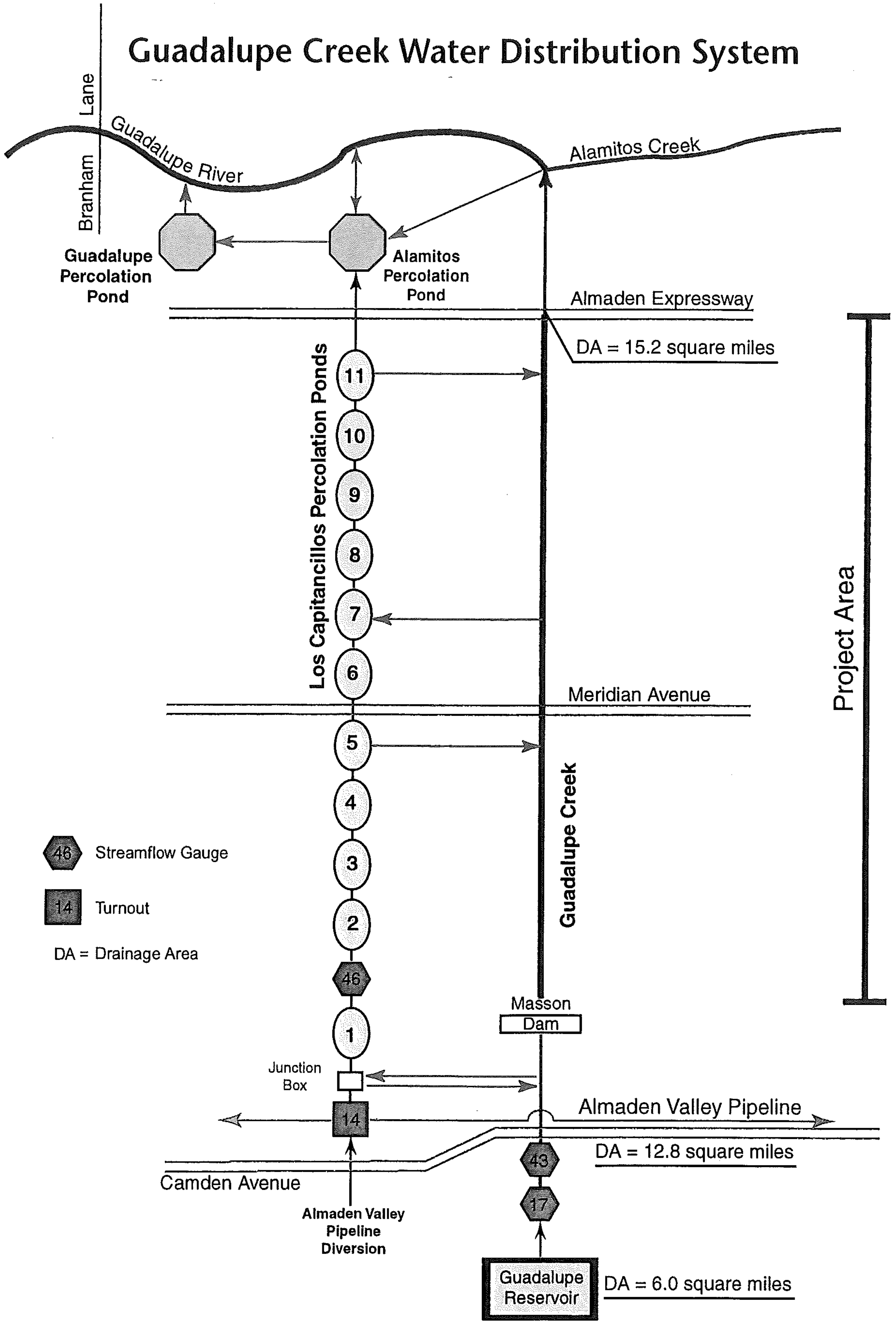


Figure 3-17
Guadalupe Creek Water Distribution System

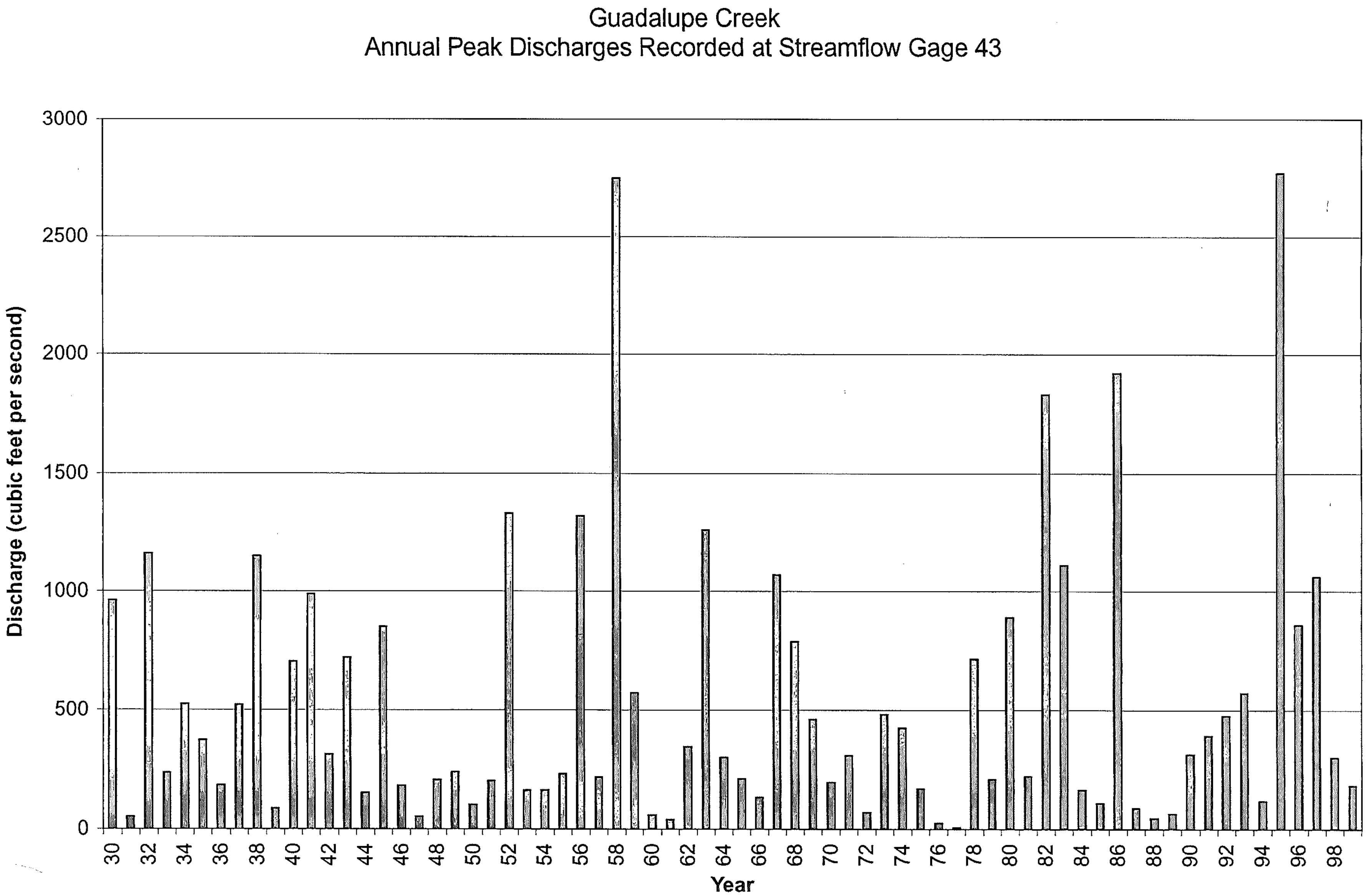


Figure 3-18
Annual Peak Discharges Recorded at Streamflow Gage 43

The flow frequency and annual peaks are plotted on Figure 3-19. The 1977 annual peak flow of 7 cfs was below the low outlier threshold and was omitted from the data set. The data plots within the 5 and 95% confidence limits and is considered to have an acceptable fit with the expected probability curve. The peak flow of record is near the 95% confidence limit. Table 3-5 shows a comparison of the flood discharge estimates developed by the Corps, the District, and NHC. Flows computed for this study generally match the flows developed by the Corps and the District. The NHC 1.5-year peak flow through the 5-year peak flow are approximately 2–5% lower than the District and Corps flows. The 10-year flow is approximately 16% lower than the District flows. Conversely, the 50- and 100-year NHC peak flows are 14 and 29% higher than the District flows.

3.1.2.3 Flow Duration

Statistical analyses may be performed on data compiled in a historical time series to determine exceedance probabilities. Frequency information developed from historical time series data is commonly shown in a flow duration curve. This flow duration relationship is particularly useful in analyzing lower flows that affect the establishment of improved fish habitat and vegetation in the project area. Flow magnitudes and durations influence the channel morphology and plant communities through the disbursing of seeds, wetting of channel surfaces and adjacent soils, sorting of material composing the bed, transport and deposition of sediment and debris, and numerous other physical and biological processes.

Table 3-5. Peak Flow Comparison for Guadalupe Creek

	Guadalupe Creek				Guadalupe River
Return Period, Year	Guadalupe Creek Restoration Study[a]	U.S. Army Corps of Engineers, 1973[b]	U.S. Army Corps of Engineers, 1977[a]	Santa Clara Valley Water District, 1994[a]	Santa Clara Valley Water District, 1978
1.5	190	NA	210	200	400
2	320	NA	340	340	880
5	790	NA	830	810	3000[c]
10	1270	NA	1300	1500	5400
50	2900	NA	2700	2500	9900[c]
100	3880	3000	3500	2800	11800

Notes:

[a] At streamflow gage (SF) 43.

[b] At Confluence with Alamitos Creek.

[c] Graphically interpolated from Guadalupe River downstream from Alamitos Creek and Guadalupe River upstream from Ross Creek discharge estimates.

NA = Not available.

Flow data are available for Guadalupe Creek at SF 43, but not in the project area. The District maintains flows of 3–4 cfs downstream from Masson Dam to comply with California

Department of Fish and Game (CDFG) regulation for maintaining a live stream and to provide water for groundwater recharge through the creek bed in the project area. Approximately 2.5–3.5 cfs of this flow infiltrates into the subsurface between Masson Dam and Almaden Expressway. The District attempts to maintain a minimum of 0.5 cfs in the creek at Almaden Expressway (Aguilera pers. comm.). During extended dry periods, the storage capacity of the Guadalupe Reservoir is not sufficient to maintain flows in the creek for the entire year. In this case, water may be imported via Almaden Valley pipeline. However, this source of water is not reliable in all years (Ricko pers. comm.).

Daily flows within the project area cannot be determined directly, but mean daily streamflow records at SF 43 are available. The flow duration relationship provides a useful basis for estimating flow in the project area in combination with information from District operations. Therefore, data at SF 43 were used to determine a flow duration relationship for the creek upstream from Masson Dam, based on SF 43 mean daily flow records for water years 1931–1998. The flow duration analysis includes the effects of regulation at Guadalupe Dam. The flow releases at the dam control flows in the creek for all but the wet periods of the year where unregulated portions of the basin produce the majority of the measured flows at SF 43. Regulated releases from the dam typically range from 2 to 10 cfs. Higher releases are made during the wet season to maintain flood storage capacity.

The flow duration curve is shown on Figure 3-20. The analysis indicates that flows greater than 11 cfs are exceeded only 10% of the time. Approximately 85% of the time flows are greater than 3 cfs, the flow that the District attempts to maintain in the creek downstream from Masson Dam. This analysis suggests that the District must import water from alternative sources 15% of the time or more to maintain desired flows in the creek and percolation ponds. During the drought of the mid 1970s, there were no recorded flows at SF 43 (or at SF 17) between June 1977 and the end of October 1978.

Comparison of streamflow records between SF 17 and SF 43 indicate that flows in Guadalupe Creek downstream from SF 43 are dominated by reservoir releases and water management practices in the late summer and fall. Streamflow records at SF 17 and SF 43 were compared for several water years (1976, 1978, 1986, 1991, 1995, 1996, and 1998) representative of various hydraulic conditions. In all water years reviewed, flows at SF 17 were greater than or equal to flows at SF 43 during September and October. In most of the water years, streamflow records at SF 43 were greater than SF 17 only during the wet part of the year. These observations suggest that tributaries downstream from Guadalupe Reservoir do not contribute flows to the creek in late summer and fall. Given that the relatively low flows at SF 43 are maintained by reservoir releases during the summer and late fall, and that operational information from the District indicates that the project area infiltrates a substantial portion of the regulated flows, at least a portion of the creek in the project area would typically be dry in late summer and fall without District water management operations. This view of the creek in the project area as a naturally ephemeral stream is supported by historical evidence such as government survey notes from the 1860s that describe the channel as a dry arroyo (Thompson 1865).

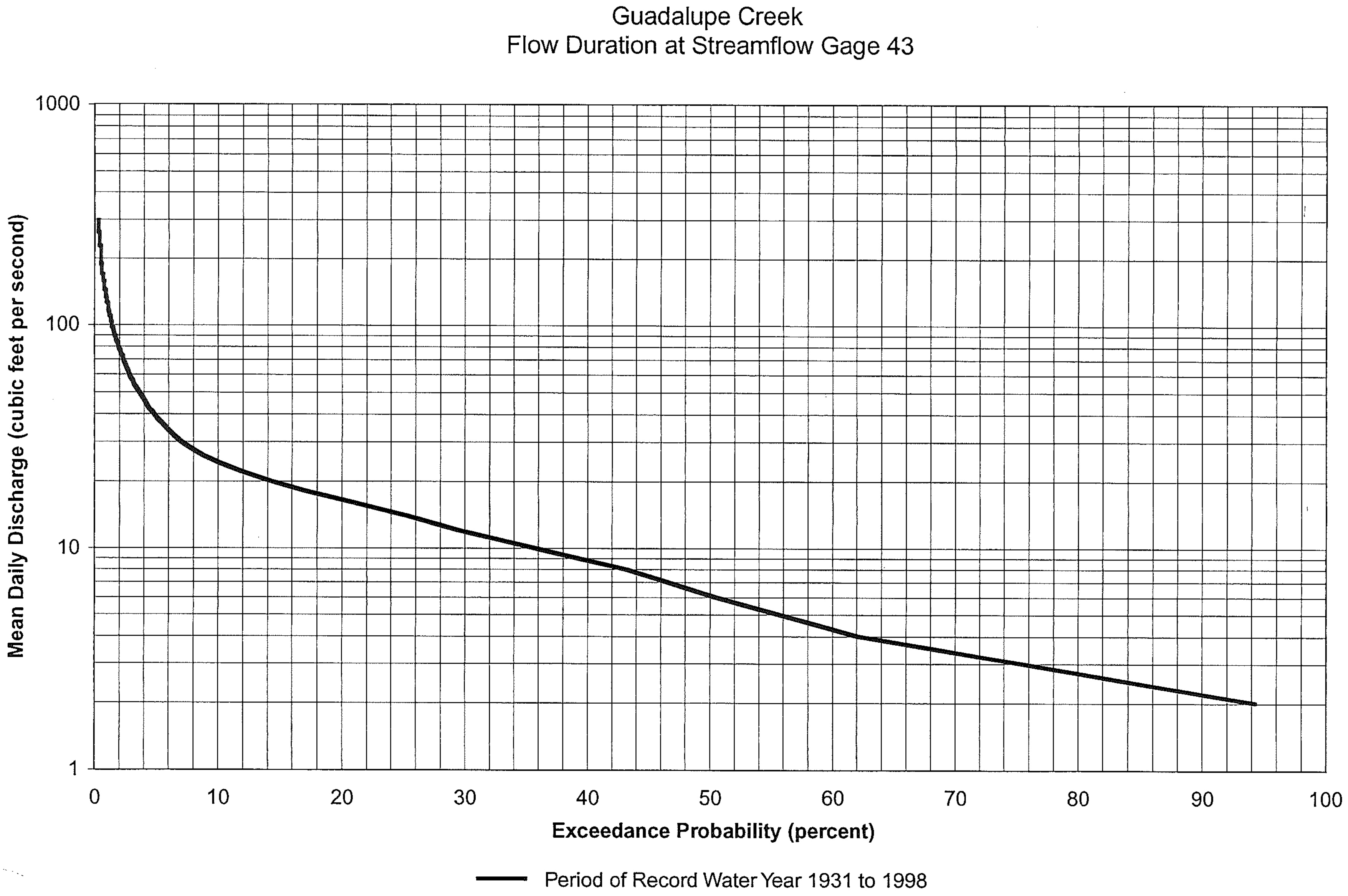


Figure 3-20
Flow Duration Curve for Streamflow Gage 43

3.1.3 Hydraulics

3.1.3.1 Introduction

Previous hydraulic studies on Guadalupe Creek have been developed by the District and the Corps to estimate flood capacity and flood hazards. The District developed a HEC-2 model using cross-section geometry from the topography shown on the 1972 as-built plans for the channel construction along Guadalupe Creek (Santa Clara Valley Water District 1972). The model was developed to estimate channel capacity and potential effects of channel maintenance activities (Rieller pers. comm.). The Corps calculated a flood profile to use in the 1973 flood hazard study (U.S. Army Corps of Engineers 1973). The report does not include support data or methodology used in the study.

The purpose of the hydraulic analysis conducted for this project is to estimate preproject hydraulic conditions for a range of flows. Hydraulic characteristics, such as velocities, depths, channel widths, and energy slopes, developed from the preproject models have been used to assess current channel stability and develop suitable project approaches and alternatives.

Changes in channel geometry and vegetation characteristics from 1973 to 1999 warranted development of an updated hydraulic model to estimate hydraulic characteristics. The preproject conditions were modeled using HEC-RAS (Hydrologic Engineering Center 1998), a one-dimensional, steady-state, gradually varied flow model. This model will be used during final design of the project to evaluate proposed channel and floodplain modifications.

3.1.3.2 Creek Description

Descriptions of the creek planform and cross-section characteristics are presented in detail in Section 3.1.

Vegetation types and densities vary across the creek as well as longitudinally along the creek. Along the waters edge within the main flow channel, aquatic vegetation exists on a seasonal basis and is susceptible to removal by seasonal high flood events. Adjacent to the low-flow channel, the vegetation density varies from unvegetated bars to dense willow and shrub/vine scrub. Vegetation along raised benches tends to be sparsely vegetated. Vegetation on the bench surfaces include annual grasses and shrubs with occasional trees.

3.1.3.3 Model Setup

A HEC-RAS model was developed for the 1.5-, 2-, 10-, 50-, and 100-year peak flows. A modified version of the model was developed for low flows, from 5 to 100 cfs, to account for differences in depth and roughness characteristics at these flows. Data required to model the creek with HEC-RAS include cross sections of channel and floodplain geometry, channel roughness estimates in the form of a Manning's roughness coefficient, geometric data on structures that may act as hydraulic controls (e.g., bridges), estimations of the effective conveyance areas, event flows developed from the flow frequency analysis, and flow estimates for typical low-flow periods. Many of the input parameters in the high- and low-flow models are similar. These parameters include cross-section geometry and bank station locations. Channel roughness values were adjusted in the low-flow model to account for the increased effect of bed roughness and vegetation at lower flows.

Cross Sections. Cross sections for the project were surveyed by NHC in November 1999 at 100–300 feet intervals along Guadalupe Creek. Forty nine cross sections were surveyed from the downstream face of Almaden Expressway Bridge upstream to approximately 60 feet downstream from Masson Dam. Control points consisting of aluminum caps over ½-inch rebar were set on the north levee at an interval of one every other surveyed cross section. Additional survey data for the Almaden Expressway and Meridian Avenue Bridges included top of bridge, soffit, pier locations, and widths. In addition to the NHC sections, five cross sections were surveyed by the District downstream from the project area in December 1999. These sections extend from the Alamitos drop structure to the Almaden Expressway Bridge. Both surveys used NAD83 as the horizontal datum and NGVD29 as the vertical datum. The stationing convention for the project area is based on the approximate centerline of the low-flow channel. Station values are based on the 1973 Corps Flood Plain Information Report profile stationing. Appendix B depicts the longitudinal stationing, cross-section locations, and orientation for the project area.

Cross-section data used in the models include NHC- and District-surveyed cross sections and three cross sections cut from aerial topography (Aelytec 1999), sections 1057, 1077, and 1183. The cross-section labeling in the model is independent of the longitudinal creek station. Cross sections surveyed by the District were labeled from downstream to upstream beginning with 100 and ending with 150. Labels for cross sections surveyed by NHC increase with distance upstream, beginning with 1008 at the downstream face of Almaden Expressway and ending at 1270. Cross sections in the model are laid out following the District convention of looking upstream from left to right.

Bridges. Upstream and downstream from the bridges, standard step calculations were used to compute the energy and water-surface elevations. Low flows through the bridges were calculated using both the standard step method and the Yarnell equation. The method with the greatest energy loss through the bridge was used to compute the water-surface profile. Pressure-flow equations were used to calculate the energy loss through the bridge when the energy grade equaled or exceeded the elevation of the soffit.

Roughness. Manning's '*n*' was used to define the roughness of the channel and overbank areas. Surface roughness, vegetation characteristics, irregularities in geometry, and flow depths were used to estimate preproject Manning's n. Roughness values for Manning's *n* varied from 0.035 in areas of sparse vegetation and/or annual grasses to a high of 0.15 at a dense willow stand at cross section 1090.

Bank Stations. Bank stations were set at locations to define the approximate boundaries of the main flow corridor of the creek. This corridor was identified through the use of topographic data superimposed on aerial photographs, cross-section data, and field observations.

Levee Stations. HEC-RAS levee stations were used in the model to define the lateral boundaries of the creek. The levee function in HEC-RAS confines the conveyance area to the area between the levees until an iterative computation of the water-surface elevation is greater than the top of the levee. When the levee is overtopped, the model recomputes the water-surface elevation using the areas on both sides of the overtopped levee as conveyance area.

Ineffective Flow Limits. Ineffective flow areas can be set in HEC-RAS to define the active cross-sectional conveyance area. Ineffective areas often occur where there are large variations in the cross-section width between adjacent upstream and/or downstream sections. Ineffective areas were specified in cross sections 1210–1270 to delineate areas in active conveyance along a broad bench on the south side of the channel 2. This approach was used to estimate velocities and depths to be used in the development of alternatives. An ineffective flow limit was also placed on the northerly bench at cross section 1175 to model flow expansion.

Flow Classification. The model extends downstream from the project area to the Alamitos Weir on the Guadalupe River. The model was set up to compute subcritical flow at each cross section. Field observations and experience suggest that supercritical flow conditions would not occur over an appreciable distance.

Starting Water Surface. Starting water-surface elevations for all flows were based on critical flow at the Alamitos drop structure crest. Modeled flows increase in the Guadalupe River reach between the Alamitos drop structure and the confluence of Guadalupe and Alamitos Creeks. These flows are based on District flow frequency analysis (District 1978).

3.1.3.4 HEC-RAS Model Results

Introduction. The purpose of developing a hydraulic model of the project area is to estimate hydraulic characteristics for several steady-state flows. Reach-averaged hydraulic characteristics were computed and used to estimate the capacity of the creek and calculate sediment transport potential. Additionally, these results were compared with geomorphic observations and used to illustrate the differences between the geomorphic reaches. These analyses were used in developing design objectives and criteria. The computed water-surface profiles were compared with previous District and Corps water-surface profiles.

Model Stability. In general the model produced flow depths and velocities that are typical of unlined vegetated channels with similar characteristics. However, computed water surfaces at some locations for various flows did not converge to a subcritical solution and defaulted to a minimum energy solution. Physical characteristics of the creek, such as steep channel slopes, abrupt changes in channel geometry, and vegetation, may result in the occurrence of critical flow conditions at discrete locations along the creek during an actual runoff event.

Model Calibration. High water marks were collected at 10 locations along the project area following the peak flow of 535 cfs February 14, 2000. This flow has a return period of approximately 3 years. Computed water-surface elevations at this flow were compared with actual water-surface elevations to determine the accuracy of the model. For the project area downstream from cross section 1120, the model results were within 0.2 feet of the highwater marks. The computed water-surface elevations were 0.8–0.7 feet above the highwater marks measured at cross sections 1140 and 1160. At cross section 1185 the model defaulted to a critical depth solution. The default solution at cross section 1185 was 0.5 feet below the measured highwater mark.

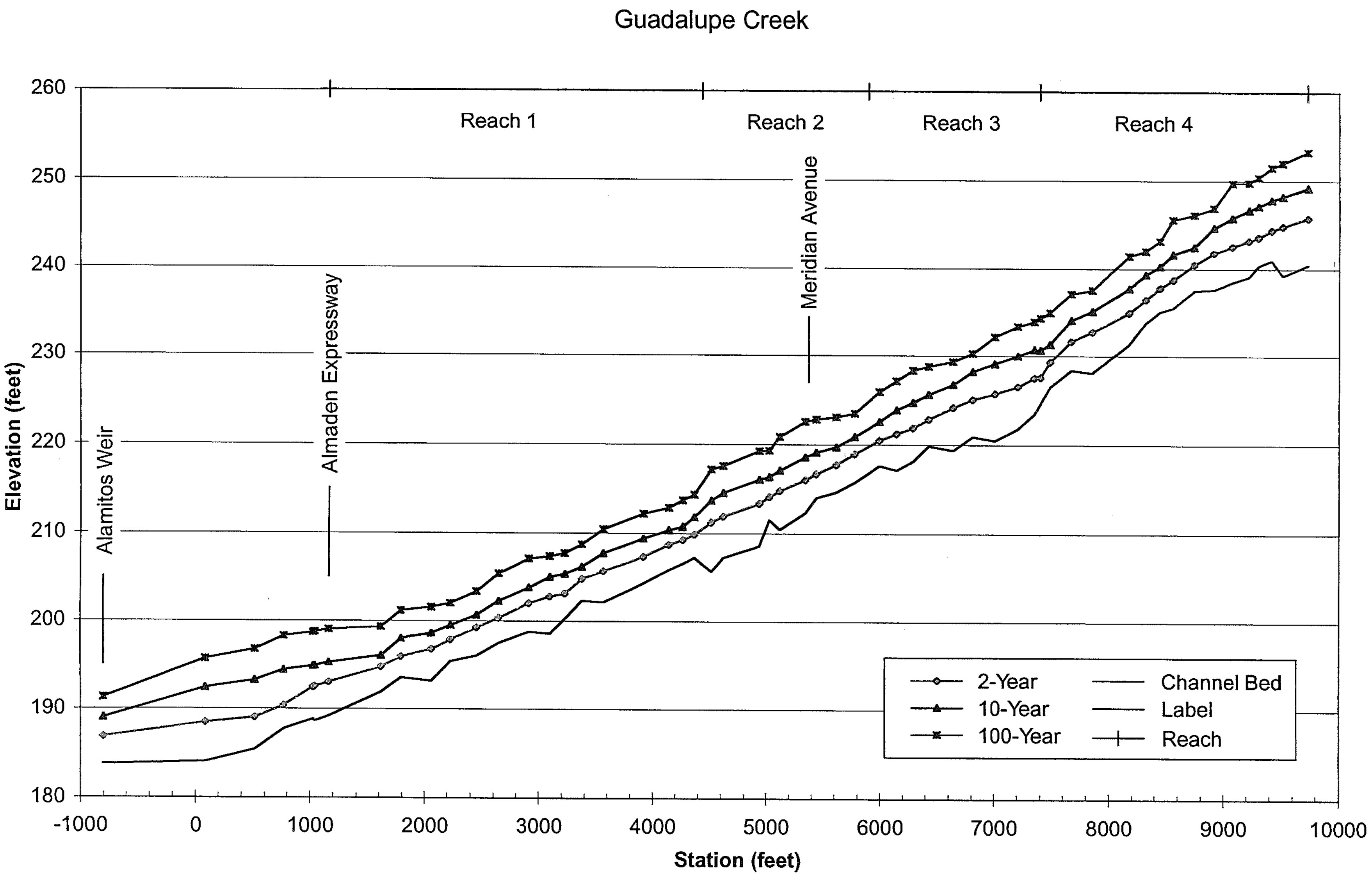
Model Results. Hydraulic characteristics were calculated for the 1.5-, 2-, 5-, 10-, 50-, and 100-year peak flows. The model results are shown in Table 3-6. The 1.5-, 2-, and 5-year peak flows are conveyed through the channel without appreciable backwater effects resulting from channel constrictions or bridges. The confluence of Guadalupe and Alamitos Creeks, Alamitos Expressway Bridge, and Meridian Bridge act as hydraulic controls, causing backwater in the 10-, 50-, and 100-year water-surface profiles to upstream from these controls.

Water-surface profiles for the 2-, 10-, and 100-year peak flows are plotted on Figure 3-21. Average velocities for the entire cross section are plotted for the 2-year and 100-year peak flows in Figure 3-22. These values are highly variable from cross section to cross section; however, the plots show a decreasing trend in the downstream direction.

The active top width is defined as the top width within the effective flow limits. Active top widths for the 2- and 100-year peak flows are plotted in Figure 3-23. As shown in the figure, the 2-year flow has a relatively consistent top width that increases in the downstream direction. The 2-year peak flow is confined within the main channel throughout the project area. Changes in width from cross section to cross section become larger with increasing flow. As the flow increases, water spreads out laterally across the benches; at higher flows, changes in top width become a function of the bench geometry. The main channel confines the 1.5- and 2-year events at every cross section. Higher flows, such as the 10-year flow, vary from cross section to cross section between confinement within the main channel and flow in both the main channel and on the bench. The 50- and 100-year flows are confined to the main channel in a few locations, such as downstream from Meridian Bridge.

Four subreaches were defined within the project area by identifying regions of distinctly similar geomorphic characteristics. A discussion of these delineations is provided in Section 3.1 of this report. Computed hydraulic characteristics correspond well with the distributions between geomorphic reaches.

Reach-averaged characteristics of the main channel were computed for velocity, hydraulic depth, and width. These parameters were weighted by reach distance. An average energy slope for the reach was computed by subtracting the energy grade at the upstream end of the reach from the energy grade at the downstream end of the reach and dividing by the reach distance. Table 3-7 shows the reach-averaged characteristics.



Jones & Stokes
nhc

Figure 3-21
Computed 2-, 10-, and 100-Year Water-Surface Profiles

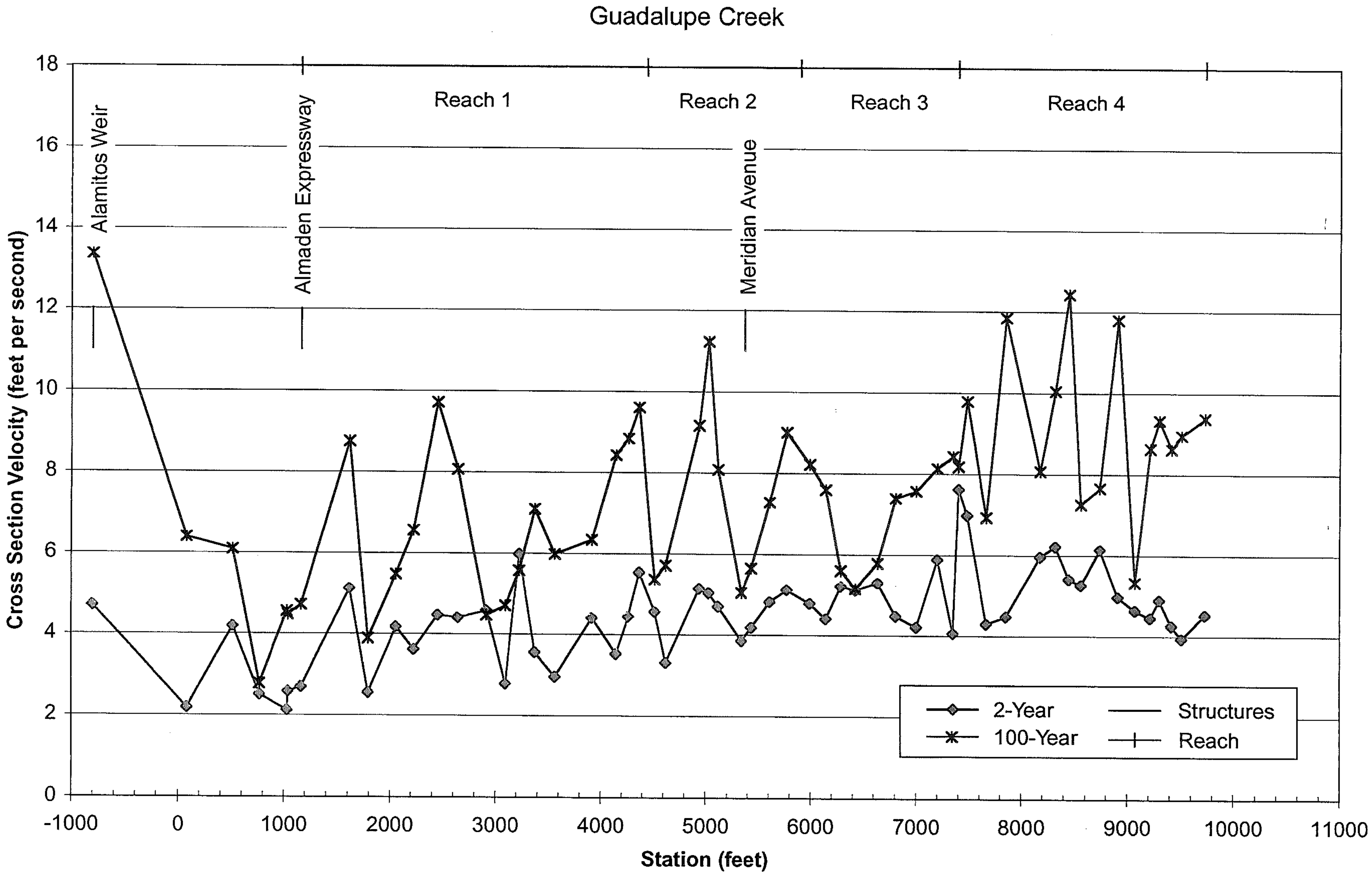


Figure 3-22
Computed Velocity Profile

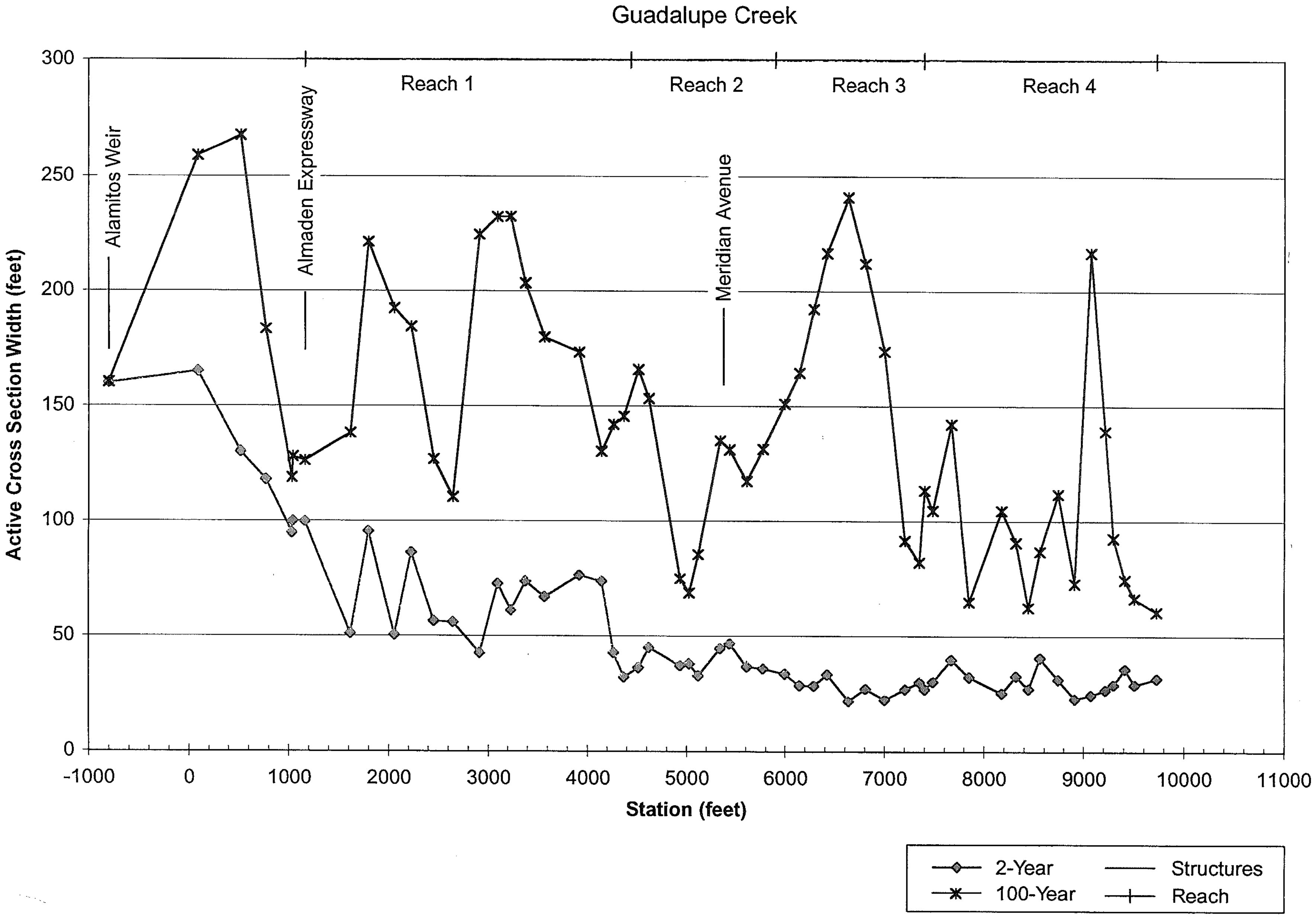


Figure 3-23
Computed Active Channel Widths

Table 3-6. HEC-RAS Hydraulic Output Summary for Guadalupe Creek

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
100	400	183.7	186.34	186.67	0.001786	5.28	116.56	159.61	0.58	0.71
100	880	183.7	186.79	187.28	0.002588	7.06	187.72	159.61	0.72	0.76
100	3000	183.7	187.96	189.06	0.003710	10.53	375.48	159.64	0.90	0.92
100	5400	183.7	188.99	190.62	0.003773	12.28	539.02	159.66	0.95	0.96
100	9900	183.7	190.60	193.06	0.003578	14.30	795.90	159.69	0.96	0.98
100	12000	183.7	191.25	194.07	0.003516	15.06	900.49	159.70	0.97	0.99
110	400	184.0	187.48	187.53	0.000575	1.79	260.51	145.98	0.21	0.20
110	880	184.0	188.43	188.53	0.000845	2.69	406.39	164.82	0.26	0.24
110	3000	184.0	190.72	191.04	0.001397	4.94	828.97	192.32	0.37	0.31
110	5400	184.0	192.37	192.93	0.001753	6.58	1157.99	205.03	0.43	0.35
110	9900	184.0	194.68	195.64	0.002164	8.80	1653.10	234.44	0.50	0.40
110	12000	184.0	195.59	196.73	0.002285	9.61	1882.58	258.54	0.52	0.42
120	400	185.4	187.93	188.18	0.006606	4.02	99.42	78.74	0.63	0.63
120	880	185.4	188.96	189.28	0.004146	4.58	210.97	129.91	0.55	0.58
120	3000	185.4	191.42	191.91	0.002748	6.17	710.37	218.61	0.51	0.41
120	5400	185.4	193.20	193.87	0.002561	7.40	1106.22	225.38	0.52	0.39
120	9900	185.4	195.68	196.65	0.002547	9.18	1711.42	265.07	0.54	0.40
120	12000	185.4	196.68	197.76	0.002504	9.77	1976.99	267.33	0.55	0.39
140	220	187.7	189.85	189.95	0.007779	2.61	91.87	93.87	0.40	0.43
140	360	187.7	190.35	190.47	0.006292	2.91	144.59	117.64	0.38	0.40
140	825	187.7	192.48	192.56	0.001613	2.47	415.30	133.57	0.22	0.20
140	1250	187.7	194.36	194.43	0.000908	2.40	693.47	175.25	0.18	0.16
140	2900	187.7	197.12	197.24	0.001010	3.28	1183.07	180.21	0.20	0.17
140	3800	187.7	198.20	198.35	0.001092	3.69	1379.80	182.80	0.21	0.18
150	220	188.8	191.97	192.01	0.007949	1.57	132.20	92.78	0.24	0.25
150	360	188.8	192.38	192.45	0.009280	2.02	170.70	94.62	0.27	0.28
150	825	188.8	193.34	193.49	0.012108	3.10	263.15	98.70	0.33	0.34
150	1250	188.8	194.82	194.96	0.006590	3.07	413.23	103.83	0.27	0.27
150	2900	188.3	197.56	197.83	0.006565	4.30	711.18	113.90	0.29	0.29
150	3800	188.8	198.66	198.99	0.006847	4.84	838.88	118.49	0.30	0.30

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1008	220	188.6	192.03	192.11	0.007757	2.41	103.42	72.85	0.31	0.31
1008	360	188.6	192.45	192.57	0.010146	3.15	140.09	99.85	0.37	0.38
1008	825	188.6	193.42	193.63	0.010587	4.09	239.52	104.10	0.40	0.40
1008	1250	188.6	194.86	195.03	0.005193	3.66	393.85	110.79	0.30	0.30
1008	2900	188.6	197.61	197.88	0.004458	4.61	715.05	122.66	0.30	0.30
1008	3800	188.6	198.72	199.05	0.004473	5.07	853.65	127.56	0.31	0.30
1009	Bridge									
1010	220	189.2	192.50	192.59	0.001815	2.68	93.84	69.29	0.35	0.36
1010	360	189.2	192.99	193.13	0.002201	3.28	134.55	99.61	0.39	0.41
1010	825	189.2	194.05	194.24	0.002091	3.95	242.21	104.21	0.39	0.39
1010	1250	189.2	195.24	195.43	0.001325	3.77	369.32	109.64	0.31	0.32
1010	2900	189.2	197.96	198.26	0.001096	4.59	684.29	121.55	0.30	0.31
1010	3800	189.2	198.98	199.34	0.001137	5.08	809.78	126.03	0.31	0.33
1020	220	191.9	194.18	194.61	0.017584	5.34	43.82	49.96	0.88	0.94
1020	360	191.9	194.71	195.13	0.011261	5.41	70.48	50.82	0.74	0.76
1020	825	191.9	195.53	196.38	0.013259	7.66	112.43	51.61	0.86	0.88
1020	1250	191.9	196.02	197.32	0.015938	9.47	137.94	53.12	0.97	0.99
1020	2900	191.9	198.45	199.93	0.008785	10.50	329.91	124.14	0.80	0.95
1020	3800	191.9	199.25	200.77	0.007902	10.93	435.18	137.88	0.77	0.87
1025	220	193.5	195.49	195.57	0.002539	2.52	104.68	93.17	0.35	0.35
1025	360	193.5	195.89	196.00	0.002642	2.94	141.94	95.19	0.37	0.37
1025	825	193.5	197.05	197.21	0.002167	3.59	255.29	100.66	0.36	0.36
1025	1250	193.5	197.94	198.15	0.001884	3.97	348.49	133.17	0.35	0.39
1025	2900	193.5	200.33	200.55	0.001403	4.69	817.16	210.22	0.33	0.32
1025	3800	193.5	201.10	201.36	0.001360	4.99	981.92	221.06	0.33	0.32
1030	220	193.1	196.29	196.46	0.004460	3.46	65.25	42.69	0.44	0.48
1030	360	193.1	196.74	197.01	0.005576	4.33	86.46	50.11	0.50	0.56
1030	825	193.1	197.79	198.23	0.007069	6.10	166.26	89.17	0.59	0.64

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1030	1250	193.1	198.56	199.03	0.005924	6.31	237.27	95.92	0.55	0.59
1030	2900	193.1	200.74	201.19	0.003885	6.51	555.54	185.02	0.46	0.53
1030	3800	193.1	201.49	201.97	0.003633	6.69	696.26	191.97	0.45	0.51
1035	220	195.3	197.26	197.50	0.008996	4.05	57.57	58.33	0.64	0.68
1035	360	195.3	197.82	198.04	0.006898	3.94	99.85	86.17	0.58	0.59
1035	825	195.3	198.87	199.17	0.004643	4.65	194.97	94.10	0.52	0.52
1035	1250	195.3	199.49	199.89	0.004726	5.43	254.33	98.85	0.54	0.54
1035	2900	195.3	201.26	201.95	0.004784	7.37	458.52	175.30	0.59	0.69
1035	3800	195.3	201.93	202.72	0.004821	8.07	580.72	183.88	0.60	0.65
1040	220	195.9	198.71	198.93	0.004695	3.76	58.51	38.87	0.54	0.54
1040	360	195.9	199.19	199.50	0.005912	4.46	80.74	56.11	0.65	0.66
1040	825	195.9	200.04	200.67	0.008825	6.38	130.15	59.58	0.75	0.76
1040	1250	195.9	200.64	201.53	0.010002	7.61	166.33	61.61	0.79	0.81
1040	2900	195.9	202.19	204.14	0.013502	11.30	269.24	85.23	0.95	1.07
1040	3800	195.9	203.31	205.11	0.009805	11.13	392.27	126.60	0.84	0.97
1045	220	197.4	199.74	200.00	0.006555	4.18	54.79	41.15	0.57	0.61
1045	360	197.4	200.30	200.64	0.005941	4.84	81.97	55.63	0.57	0.64
1045	825	197.4	201.47	201.97	0.005334	6.08	152.34	63.14	0.58	0.61
1045	1250	197.4	202.25	202.89	0.005189	6.89	203.47	67.18	0.59	0.62
1045	2900	197.4	204.66	205.59	0.004396	8.60	404.52	101.98	0.59	0.63
1045	3800	197.4	205.30	206.48	0.005152	9.90	472.06	110.15	0.65	0.69
1050	220	198.7	201.40	201.62	0.005559	3.81	57.76	35.13	0.52	0.52
1050	360	198.7	201.95	202.27	0.006304	4.59	78.80	42.23	0.57	0.59
1050	825	198.7	203.02	203.68	0.007280	6.58	132.33	60.06	0.66	0.74
1050	1250	198.7	203.75	204.58	0.007240	7.57	190.38	119.84	0.69	0.92
1050	2900	198.7	206.10	206.48	0.002366	5.97	660.90	219.30	0.43	0.45
1050	3800	198.7	206.98	207.34	0.001900	5.85	855.88	224.36	0.39	0.40
1055	220	198.5	202.10	202.21	0.002081	2.71	87.14	58.78	0.33	0.37
1055	360	198.5	202.75	202.90	0.002096	3.21	130.37	72.64	0.35	0.36

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1055	825	198.5	204.13	204.39	0.002259	4.41	237.90	82.58	0.39	0.36
1055	1250	198.5	204.97	205.34	0.002518	5.29	318.03	137.54	0.42	0.46
1055	2900	198.5	206.47	207.04	0.003373	7.31	625.08	227.75	0.51	0.49
1055	3800	198.5	207.28	207.81	0.002857	7.29	812.01	231.96	0.48	0.44
1057	220	200.2	202.44	203.02	0.023311	6.12	35.94	31.65	1.01	1.01
1057	360	200.2	203.06	203.64	0.016808	6.08	60.30	60.85	0.89	1.06
1057	825	200.2	204.44	204.95	0.006877	6.08	155.09	82.00	0.64	0.68
1057	1250	200.2	205.33	205.86	0.005306	6.42	240.94	120.16	0.59	0.65
1057	2900	200.2	206.92	207.65	0.005458	8.26	517.03	223.35	0.63	0.65
1057	3800	200.2	207.64	208.34	0.004645	8.30	683.64	232.25	0.60	0.57
1060	220	202.2	204.25	204.43	0.004893	3.42	69.13	59.84	0.48	0.52
1060	360	202.2	204.73	204.97	0.005362	4.08	101.64	73.55	0.52	0.53
1060	825	202.2	205.52	206.06	0.007887	6.16	164.01	81.19	0.67	0.62
1060	1250	202.2	206.17	206.88	0.008018	7.19	217.67	84.76	0.70	0.63
1060	2900	202.2	207.48	209.10	0.012385	11.18	335.58	117.97	0.92	0.90
1060	3800	202.2	208.61	209.83	0.007717	10.23	537.56	203.16	0.75	0.77
1065	220	202.1	205.08	205.21	0.003487	3.00	85.00	64.23	0.38	0.40
1065	360	202.1	205.65	205.83	0.003845	3.60	122.39	66.87	0.40	0.38
1065	825	202.1	206.89	207.23	0.004891	5.08	208.79	72.58	0.47	0.41
1065	1250	202.1	207.67	208.17	0.005668	6.12	267.37	76.74	0.51	0.44
1065	2900	202.1	210.00	210.60	0.004947	7.37	567.58	177.24	0.50	0.50
1065	3800	202.1	210.39	211.18	0.006184	8.53	637.11	179.38	0.56	0.56
1070	220	204.3	206.67	206.94	0.006998	4.20	52.35	32.69	0.59	0.59
1070	360	204.3	207.30	207.64	0.006773	4.69	81.91	76.38	0.59	0.75
1070	825	204.3	208.52	208.89	0.004520	5.18	176.57	78.29	0.52	0.55
1070	1250	204.3	209.37	209.80	0.003880	5.57	244.50	81.19	0.49	0.52
1070	2900	204.3	211.43	212.07	0.003574	6.93	489.60	169.50	0.50	0.61
1070	3800	204.3	212.09	212.81	0.003631	7.49	601.58	172.86	0.51	0.60
1075	220	205.8	208.08	208.28	0.005118	3.73	64.91	59.66	0.51	0.57

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1075	360	205.8	208.63	208.84	0.004297	4.02	102.44	73.61	0.48	0.52
1075	825	205.8	209.57	209.94	0.004766	5.19	173.27	76.29	0.53	0.56
1075	1250	205.8	210.30	210.76	0.004598	5.73	229.66	78.45	0.54	0.56
1075	2900	205.8	212.22	213.09	0.004988	7.49	387.44	88.61	0.59	0.63
1075	3800	205.8	212.81	213.96	0.005713	8.63	452.02	129.98	0.65	0.79
1077	220	206.5	208.70	208.90	0.005135	3.56	61.79	39.43	0.50	0.50
1077	360	206.5	209.18	209.48	0.006155	4.43	81.18	42.55	0.57	0.57
1077	825	206.5	210.12	210.80	0.009238	6.62	124.76	49.92	0.73	0.74
1077	1250	206.5	210.71	211.73	0.010583	8.12	156.24	57.10	0.80	0.85
1077	2900	206.5	212.72	214.42	0.009690	10.79	308.15	116.17	0.84	1.02
1077	3800	206.5	213.65	215.26	0.007940	10.90	431.47	141.73	0.78	0.89
1080	220	207.2	209.29	209.61	0.008480	4.55	48.39	30.59	0.64	0.64
1080	360	207.2	209.83	210.30	0.009070	5.53	65.09	31.94	0.68	0.68
1080	825	207.2	211.01	211.93	0.011245	7.73	110.11	53.48	0.80	0.92
1080	1250	207.2	211.76	212.87	0.010743	8.71	162.05	81.39	0.81	0.96
1080	2900	207.2	213.98	215.37	0.008057	10.40	356.50	122.45	0.76	0.84
1080	3800	207.2	214.27	216.43	0.011956	13.09	396.58	145.18	0.93	1.02
1085	220	205.6	210.48	210.70	0.006324	3.78	58.19	25.04	0.44	0.44
1085	360	205.6	211.18	211.52	0.007328	4.69	78.98	36.08	0.48	0.54
1085	825	205.6	212.79	213.38	0.008096	6.39	168.90	83.37	0.53	0.60
1085	1250	205.6	213.63	214.32	0.008492	7.28	245.61	100.05	0.56	0.57
1085	2900	205.6	215.78	216.60	0.007912	8.83	503.93	155.14	0.57	0.56
1085	3800	205.6	217.07	217.66	0.004949	7.77	712.22	165.41	0.46	0.45
1090	220	207.2	211.01	211.16	0.003023	3.04	74.55	37.95	0.32	0.37
1090	360	207.2	211.83	212.04	0.003400	3.76	109.23	44.71	0.35	0.37
1090	825	207.2	213.60	213.99	0.004259	5.30	229.93	84.29	0.41	0.38
1090	1250	207.2	214.47	215.03	0.005408	6.49	304.51	87.35	0.47	0.39
1090	2900	207.2	216.47	217.54	0.008664	9.57	523.04	141.75	0.60	0.51
1090	3800	207.2	217.44	218.41	0.007773	9.61	667.84	152.76	0.58	0.48

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1100	220	208.5	212.32	212.73	0.008310	5.16	42.62	20.61	0.63	0.63
1100	360	208.5	213.28	213.70	0.008119	5.18	70.02	36.97	0.64	0.66
1100	825	208.5	214.99	215.49	0.005027	5.81	149.69	53.97	0.55	0.58
1100	1250	208.5	215.98	216.59	0.004480	6.49	205.88	58.86	0.54	0.57
1100	2900	208.5	218.40	219.47	0.004595	8.77	362.65	70.87	0.59	0.62
1100	3800	208.5	219.14	220.53	0.005305	10.08	416.06	74.62	0.64	0.68
1105	220	211.4	213.27	213.65	0.013580	4.96	44.40	35.37	0.78	0.78
1105	360	211.4	214.02	214.41	0.008151	5.02	71.75	37.66	0.64	0.64
1105	825	211.4	215.41	216.07	0.007579	6.49	127.13	41.92	0.66	0.66
1105	1250	211.4	216.29	217.18	0.007698	7.58	166.11	47.95	0.68	0.71
1105	2900	211.4	218.51	220.18	0.008276	10.58	292.87	64.50	0.76	0.82
1105	3800	211.4	219.21	221.37	0.009422	12.14	339.27	68.46	0.82	0.89
1110	220	210.4	214.07	214.29	0.004040	3.76	58.56	27.73	0.46	0.46
1110	360	210.4	214.68	215.02	0.005395	4.69	76.83	32.49	0.54	0.54
1110	825	210.4	216.06	216.70	0.006256	6.46	133.72	54.44	0.62	0.69
1110	1250	210.4	217.00	217.80	0.005849	7.35	190.16	64.44	0.62	0.67
1110	2900	210.4	219.67	220.80	0.004807	9.16	381.86	79.22	0.61	0.61
1110	3800	210.4	220.76	222.05	0.004620	9.88	471.58	85.09	0.61	0.60
1114	220	212.2	215.17	215.41	0.006320	4.14	61.39	40.65	0.55	0.51
1114	360	212.2	215.93	216.20	0.005061	4.47	93.69	44.42	0.52	0.47
1114	825	212.2	217.49	217.85	0.003809	5.37	198.90	87.48	0.49	0.48
1114	1250	212.2	218.47	218.86	0.003147	5.70	291.23	99.92	0.46	0.44
1114	2900	212.2	221.23	221.69	0.002145	6.39	603.45	124.58	0.41	0.38
1114	3800	212.2	222.42	222.92	0.001933	6.69	757.66	134.69	0.40	0.37
1115	Bridge									
1116	220	213.9	215.96	216.18	0.006582	3.77	58.38	40.55	0.55	0.55
1116	360	213.9	216.61	216.88	0.005333	4.19	86.33	46.35	0.52	0.54
1116	825	213.9	218.10	218.49	0.004293	5.09	171.35	71.74	0.50	0.55
1116	1250	213.9	219.00	219.44	0.003730	5.55	251.45	97.61	0.49	0.55

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1116	2900	213.9	221.55	222.07	0.002449	6.25	530.08	120.04	0.43	0.46
1116	3800	213.9	222.71	223.25	0.002124	6.48	674.84	130.79	0.41	0.44
1120	220	214.5	217.11	217.35	0.006497	3.94	55.86	34.92	0.55	0.55
1120	360	214.5	217.63	217.99	0.007107	4.82	74.68	36.49	0.59	0.59
1120	825	214.5	218.88	219.51	0.006915	6.49	136.84	62.70	0.63	0.72
1120	1250	214.5	219.63	220.42	0.007000	7.48	189.69	80.45	0.66	0.76
1120	2900	214.5	221.86	222.77	0.004948	8.44	402.27	106.13	0.59	0.65
1120	3800	214.5	222.95	223.85	0.004055	8.50	523.49	116.87	0.55	0.60
1125	220	215.6	218.20	218.50	0.007644	4.41	49.91	30.14	0.60	0.60
1125	360	215.6	218.83	219.23	0.008184	5.11	70.42	35.61	0.64	0.64
1125	825	215.6	220.06	220.77	0.008464	6.83	127.41	61.04	0.69	0.79
1125	1250	215.6	220.80	221.66	0.008219	7.73	178.72	74.41	0.70	0.80
1125	2900	215.6	222.56	223.96	0.008730	10.29	325.73	97.22	0.77	0.86
1125	3800	215.6	223.42	224.95	0.008357	11.08	423.56	130.86	0.77	0.88
1140	220	217.5	219.75	220.01	0.006155	4.07	54.01	31.63	0.55	0.55
1140	360	217.5	220.40	220.76	0.005988	4.78	75.28	33.32	0.56	0.56
1140	825	217.5	221.76	222.46	0.007093	6.70	123.80	39.97	0.64	0.67
1140	1250	217.5	222.48	223.53	0.008384	8.28	154.65	46.08	0.72	0.78
1140	2900	217.5	225.07	226.51	0.006701	10.27	353.48	135.61	0.70	0.90
1140	3800	217.5	225.83	227.30	0.006379	10.77	463.40	150.57	0.70	0.82
1145	220	217.0	220.44	220.63	0.003014	3.53	62.32	25.00	0.39	0.39
1145	360	217.0	221.17	221.47	0.003868	4.40	81.89	28.49	0.46	0.46
1145	825	217.0	222.80	223.38	0.005350	6.13	134.58	36.25	0.56	0.56
1145	1250	217.0	223.82	224.62	0.006113	7.19	173.99	41.79	0.61	0.62
1145	2900	217.0	226.34	227.44	0.005472	8.95	393.58	147.53	0.62	0.79
1145	3800	217.0	227.03	228.21	0.005449	9.56	501.36	163.91	0.63	0.76
1150	220	218.0	220.99	221.33	0.007479	4.65	47.29	25.22	0.60	0.60
1150	360	218.0	221.81	222.23	0.006706	5.21	69.15	28.25	0.59	0.59
1150	825	218.0	223.60	224.27	0.006598	6.57	125.51	35.46	0.61	0.62

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1150	1250	218.0	224.70	225.49	0.005862	7.27	182.52	56.06	0.59	0.67
1150	2900	218.0	227.48	228.07	0.003041	7.15	541.51	186.74	0.46	0.55
1150	3800	218.0	228.22	228.82	0.002856	7.38	681.60	191.81	0.45	0.52
1155	220	219.7	222.08	222.41	0.008475	4.55	48.31	30.10	0.63	0.63
1155	360	219.7	222.78	223.19	0.007462	5.11	70.46	33.17	0.62	0.62
1155	825	219.7	224.55	225.12	0.005957	6.06	136.03	40.92	0.59	0.59
1155	1250	219.7	225.56	226.26	0.005379	6.81	199.20	90.83	0.58	0.75
1155	2900	219.7	227.97	228.48	0.002858	6.69	585.63	211.21	0.46	0.52
1155	3800	219.7	228.69	229.20	0.002593	6.82	739.14	216.20	0.44	0.49
1160	220	219.3	223.36	223.64	0.004113	4.20	52.34	18.75	0.44	0.44
1160	360	219.3	224.14	224.58	0.005563	5.30	67.92	21.61	0.53	0.53
1160	825	219.3	225.79	226.67	0.007707	7.55	113.40	51.63	0.65	0.87
1160	1250	219.3	226.70	227.68	0.007322	8.40	182.60	88.62	0.66	0.84
1160	2900	219.3	228.55	229.47	0.006128	9.48	490.27	230.17	0.64	0.71
1160	3800	219.3	229.26	230.03	0.004945	9.09	658.49	240.52	0.58	0.61
1165	220	220.8	224.11	224.35	0.004278	3.94	55.78	25.31	0.47	0.47
1165	360	220.8	225.05	225.36	0.003815	4.47	80.48	27.07	0.46	0.46
1165	825	220.8	227.18	227.68	0.004425	5.69	144.93	37.49	0.51	0.51
1165	1250	220.8	228.18	228.85	0.006129	6.57	190.83	53.78	0.61	0.61
1165	2900	220.8	229.78	230.73	0.006860	8.51	429.86	209.40	0.68	0.83
1165	3800	220.8	230.18	231.28	0.007495	9.38	515.41	211.66	0.72	0.83
1170	220	220.4	224.76	224.94	0.002163	3.37	65.34	20.12	0.33	0.33
1170	360	220.4	225.72	225.99	0.002729	4.20	85.64	22.22	0.38	0.38
1170	825	220.4	227.91	228.44	0.003364	5.86	146.55	37.80	0.44	0.50
1170	1250	220.4	229.07	229.78	0.003697	6.98	199.51	53.71	0.48	0.57
1170	2900	220.4	230.56	232.47	0.008150	11.86	290.90	68.01	0.73	0.85
1170	3800	220.4	232.05	233.39	0.005385	10.77	503.50	173.18	0.61	0.78
1175	220	221.7	225.38	225.96	0.013691	6.11	35.99	19.22	0.79	0.79
1175	360	221.7	226.48	227.01	0.009580	5.88	61.27	26.80	0.68	0.68

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1175	825	221.7	228.77	229.31	0.005666	5.94	139.00	40.41	0.56	0.56
1175	1250	221.7	229.98	230.65	0.004936	6.55	192.98	48.66	0.55	0.57
1175	2900	221.7	232.81	233.65	0.003724	7.84	427.35	126.97	0.51	0.55
1175	3800	221.7	233.26	234.45	0.004916	9.38	468.71	155.66	0.60	0.63
1180	220	223.3	226.61	226.79	0.002913	3.46	63.76	26.97	0.39	0.40
1180	360	223.3	227.49	227.75	0.002923	4.09	88.89	29.94	0.41	0.41
1180	825	223.3	229.52	229.94	0.003258	5.24	161.46	41.70	0.46	0.46
1180	1250	223.3	230.68	231.24	0.003270	6.08	216.54	66.95	0.47	0.57
1180	2900	223.3	233.25	234.23	0.003638	8.42	404.26	79.07	0.54	0.56
1180	3800	223.3	233.84	235.20	0.004634	9.98	451.99	81.87	0.61	0.63
1183	220	224.5	226.95	227.66	0.022105	6.77	32.49	23.23	1.01	1.01
1183	360	224.5	227.53	228.44	0.020664	7.62	47.25	26.81	1.01	1.01
1183	825	224.5	229.49	230.35	0.010229	7.43	110.99	38.24	0.77	0.77
1183	1250	224.5	230.66	231.61	0.008084	7.85	162.12	53.10	0.71	0.78
1183	2900	224.5	233.41	234.48	0.005006	8.84	379.92	100.58	0.61	0.69
1183	3800	224.5	234.23	235.47	0.005127	9.69	465.50	113.07	0.63	0.71
1185	220	226.4	228.72	229.29	0.017825	6.10	36.07	25.60	0.91	0.91
1185	360	226.4	229.27	230.03	0.018002	6.97	51.65	30.16	0.94	0.94
1185	825	226.4	230.45	231.73	0.018121	9.07	90.95	35.52	1.00	1.00
1185	1250	226.4	231.33	232.92	0.017013	10.13	123.35	38.59	1.00	1.00
1185	2900	226.4	234.15	235.74	0.009034	10.65	316.32	100.12	0.80	0.91
1185	3800	226.4	234.86	236.66	0.009060	11.56	388.98	104.43	0.81	0.89
1190	220	228.3	231.04	231.24	0.006749	3.63	60.64	38.12	0.51	0.51
1190	360	228.3	231.64	231.93	0.006378	4.29	84.14	39.57	0.52	0.52
1190	825	228.3	233.09	233.59	0.005980	5.75	150.15	65.89	0.54	0.64
1190	1250	228.3	234.05	234.61	0.005174	6.28	233.50	97.98	0.52	0.61
1190	2900	228.3	236.23	236.97	0.004567	7.68	458.83	107.65	0.52	0.54
1190	3800	228.3	237.03	237.92	0.004809	8.50	549.71	141.93	0.55	0.62
1200	220	228.0	232.04	232.25	0.004645	3.67	59.96	27.19	0.44	0.44

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1200	360	228.0	232.74	233.05	0.005923	4.47	80.51	32.07	0.50	0.50
1200	825	228.0	234.27	234.83	0.007610	5.99	137.84	41.27	0.58	0.58
1200	1250	228.0	235.09	235.89	0.009103	7.21	176.08	54.94	0.64	0.70
1200	2900	228.0	236.80	238.59	0.014011	10.98	280.92	63.21	0.83	0.86
1200	3800	228.0	237.44	239.79	0.016386	12.64	321.38	64.46	0.90	0.93
1210	220	231.3	234.07	234.53	0.010800	5.43	40.53	23.05	0.72	0.72
1210	360	231.3	234.89	235.44	0.008801	5.95	60.46	25.25	0.68	0.68
1210	825	231.3	236.64	237.54	0.008498	7.61	108.35	29.65	0.70	0.70
1210	1250	231.3	237.74	238.92	0.008848	8.72	146.08	46.76	0.73	0.85
1210	2900	231.3	240.28	241.48	0.006058	9.62	360.90	98.85	0.65	0.74
1210	3800	231.3	241.37	242.52	0.004920	9.58	471.90	104.39	0.60	0.67
1215	220	233.7	235.87	236.32	0.014652	5.37	41.00	30.96	0.82	0.82
1215	360	233.7	236.41	237.00	0.013415	6.21	58.02	32.67	0.82	0.82
1215	825	233.7	238.01	238.81	0.009152	7.21	114.35	37.70	0.73	0.73
1215	1250	233.7	239.27	240.16	0.007972	7.56	165.42	45.62	0.70	0.70
1215	2900	233.7	241.13	242.63	0.009206	10.18	309.83	87.06	0.80	0.87
1215	3800	233.7	241.91	243.62	0.008870	10.99	378.82	90.57	0.80	0.86
1220	220	234.9	237.17	237.46	0.006124	4.32	50.93	26.14	0.55	0.55
1220	360	234.9	237.76	238.22	0.007209	5.41	66.56	26.99	0.61	0.61
1220	825	234.9	239.09	240.07	0.010106	7.94	103.86	29.60	0.75	0.75
1220	1250	234.9	240.25	241.43	0.011409	8.71	145.11	51.26	0.81	0.90
1220	2900	234.9	242.23	244.36	0.013200	12.00	253.29	58.29	0.92	0.97
1220	3800	234.9	243.12	245.61	0.012975	13.04	306.49	84.83	0.93	0.98
1225	220	235.4	237.89	238.25	0.007483	4.84	45.48	23.50	0.61	0.61
1225	360	235.4	238.68	239.12	0.008736	5.34	68.41	40.50	0.67	0.71
1225	825	235.4	240.40	240.86	0.004564	5.65	155.40	55.47	0.53	0.56
1225	1250	235.4	241.64	242.14	0.003365	5.95	231.07	66.39	0.48	0.51
1225	2900	235.4	244.36	245.12	0.002957	7.54	431.29	303.08	0.49	0.51
1225	3800	235.4	245.50	246.37	0.002879	8.17	525.94	535.61	0.49	0.52

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1230	220	237.4	239.74	240.26	0.016713	5.82	37.81	27.77	0.88	0.88
1230	360	237.4	240.45	241.03	0.012156	6.13	58.68	31.15	0.79	0.79
1230	825	237.4	241.41	242.69	0.017960	9.07	90.97	35.75	1.00	1.00
1230	1250	237.4	242.48	243.73	0.014356	9.07	143.13	58.61	0.92	0.98
1230	2900	237.4	244.92	245.97	0.006372	8.94	371.83	104.80	0.68	0.73
1230	3800	237.4	246.08	247.07	0.004680	8.72	497.64	683.23	0.60	0.64
1235	220	237.5	241.12	241.36	0.003292	3.85	57.13	21.01	0.41	0.41
1235	360	237.5	241.83	242.22	0.004467	4.96	72.65	22.74	0.49	0.49
1235	825	237.5	243.91	244.48	0.006636	6.09	136.03	50.31	0.61	0.65
1235	1250	237.5	244.70	245.48	0.007503	7.14	179.97	59.22	0.67	0.70
1235	2900	237.5	245.96	248.01	0.013549	11.73	259.19	161.69	0.94	1.00
1235	3800	237.5	246.88	249.17	0.012206	12.51	323.20	568.24	0.92	0.98
1240	220	238.4	241.66	241.89	0.003347	3.84	57.23	21.70	0.42	0.42
1240	360	238.4	242.55	242.89	0.003817	4.63	77.70	24.31	0.46	0.46
1240	825	238.4	244.82	245.35	0.004312	5.84	141.20	34.13	0.51	0.51
1240	1250	238.4	245.78	246.55	0.005883	7.01	178.21	42.06	0.60	0.60
1240	2900	238.4	248.61	249.27	0.004233	7.11	500.88	456.41	0.55	0.64
1240	3800	238.4	249.65	250.17	0.002777	6.48	715.73	554.16	0.46	0.51
1245	220	239.0	242.24	242.47	0.004758	3.86	56.95	23.96	0.44	0.44
1245	360	239.0	243.19	243.50	0.004608	4.44	81.05	26.62	0.45	0.45
1245	825	239.0	245.50	245.98	0.004291	5.51	149.85	33.09	0.46	0.46
1245	1250	239.0	246.69	247.35	0.005022	6.51	192.04	38.20	0.51	0.51
1245	2900	239.0	249.06	250.29	0.008615	9.07	348.80	363.18	0.70	0.92
1245	3800	239.0	249.73	251.07	0.008617	9.72	441.87	383.49	0.71	0.85
1250	220	240.3	242.69	243.00	0.008293	4.50	48.87	25.47	0.57	0.57
1250	360	240.3	243.60	243.98	0.006742	4.89	73.68	28.78	0.54	0.54
1250	825	240.3	245.88	246.36	0.004895	5.56	148.35	36.81	0.49	0.49
1250	1250	240.3	247.15	247.77	0.005047	6.32	197.90	41.18	0.51	0.51
1250	2900	240.3	249.85	250.93	0.006649	8.48	362.71	292.90	0.61	0.71
1250	3800	240.3	250.35	251.81	0.008368	9.95	408.41	305.55	0.69	0.78

Table 3-6. Continued

River Station	Flow Total (cubic feet per second)	Minimum Channel Elevation (feet)	Water Surface Elevation (feet)	Total Energy Elevation (feet)	Energy Slope (feet per feet)	Channel Velocity (feet per second)	Flow Area (square feet)	Top Width (feet)	Channel Froude Number	Cross Section Froude Number
1255	220	240.9	243.64	243.86	0.006543	3.78	58.19	33.68	0.51	0.51
1255	360	240.9	244.40	244.68	0.005493	4.25	84.71	35.57	0.49	0.49
1255	825	240.9	246.48	246.88	0.004012	5.02	164.18	41.13	0.44	0.44
1255	1250	240.9	247.81	248.30	0.004088	5.60	223.06	48.04	0.46	0.46
1255	2900	240.9	250.75	251.61	0.004989	7.45	389.41	136.51	0.54	0.54
1255	3800	240.9	251.49	252.65	0.006001	8.65	442.23	185.97	0.60	0.62
1260	220	239.1	244.10	244.25	0.002757	3.11	70.80	27.08	0.34	0.34
1260	360	239.1	244.85	245.09	0.003425	3.92	91.88	28.84	0.39	0.39
1260	825	239.1	246.85	247.29	0.004376	5.30	155.63	36.95	0.46	0.46
1260	1250	239.1	248.20	248.74	0.004848	5.91	211.50	46.51	0.49	0.49
1260	2900	239.1	251.15	252.12	0.004977	7.91	373.03	128.63	0.53	0.57
1260	3800	239.1	251.96	253.24	0.005760	9.16	426.01	163.03	0.58	0.62
1270	220	240.4	244.95	245.20	0.007105	4.05	54.35	28.92	0.52	0.52
1270	360	240.4	245.78	246.10	0.006059	4.52	79.58	31.47	0.50	0.50
1270	825	240.4	247.85	248.32	0.004908	5.49	150.32	37.03	0.48	0.48
1270	1250	240.4	249.23	249.81	0.004784	6.12	204.41	41.70	0.49	0.49
1270	2900	240.4	252.25	253.32	0.005700	8.30	351.40	55.63	0.56	0.58
1270	3800	240.4	253.24	254.59	0.006232	9.47	406.73	82.88	0.60	0.63

Table 3-7. Reach-Averaged Hydraulic Characteristics for Guadalupe Creek

Reach	Event Frequency (years)	Flow (cubic feet per second)	Channel Velocity (feet per second)	Width (feet)	Depth (feet)	Energy Slope (feet per feet)
1	1.5	220	3.8	34	1.6	0.00526
	2	360	4.3	38	2.0	0.00533
	5	825	5.6	39	3.0	0.00550
	10	1250	6.4	39	3.8	0.00536
	50	2900	7.8	39	5.8	0.00526
	100	3600	8.3	39	6.6	0.00522
2	1.5	220	4.3	27	1.9	0.00620
	2	360	4.8	32	2.3	0.00613
	5	825	6.1	35	3.7	0.00587
	10	1250	6.9	35	4.5	0.00583
	50	2900	8.7	35	6.8	0.00585
	100	3600	9.2	35	7.8	0.00579
3	1.5	220	4.3	24	2.2	0.00543
	2	360	4.9	27	2.8	0.00545
	5	825	6.3	35	3.9	0.00560
	10	1250	7.2	37	4.7	0.00573
	50	2900	9.0	38	6.9	0.00565
	100	3600	9.4	38	7.6	0.00579
4	1.5	220	4.4	27	1.9	0.00709
	2	360	5.1	30	2.5	0.00716
	5	825	6.5	36	3.6	0.00739
	10	1250	7.3	41	4.2	0.00752
	50	2900	9.2	47	6.0	0.00783
	100	3600	9.9	48	6.8	0.00799

Comparison with Previous Studies. The computed 100-year water-surface profile was compared to the water-surface profiles calculated for the Corps 1973 flood study and the District 1988 HEC-2 model. The District model was developed for maintenance purposes. Figure 3-24 shows a comparison of the three water-surface profiles. The computed water surfaces are fairly similar, within 2 feet, for the majority of the project area. The NHC profile is 3–4 feet higher than both the Corps and the District water-surface profiles near Almaden Bridge. These differences may be a result of bar formation upstream from Almaden Bridge and the presence of a dense willow stand downstream from the bridge. The Corps water-surface profile is approximately 5–6 feet lower than both the NHC and the District profiles at station 93+20. The Corps bed profile at this location was shown to be 3 feet lower than the 1999 surveyed profile and is not consistent with the 1972 District channel plans for Guadalupe Creek (Santa Clara Valley Water District 1972). Supporting cross-section data and hydraulic analysis are not available for this profile.

3.1.3.5 Reach-Averaged Sediment Transport Capacities

Introduction. Channel morphology adjusts to changes in hydrology, upstream sediment supply, vegetation, sediment size, bed composition, channel geometry, and slope. The relationship between the sediment supplied to the reach and the sediment transport capacity out of the reach is often a critical factor in the rate and degree of channel change.

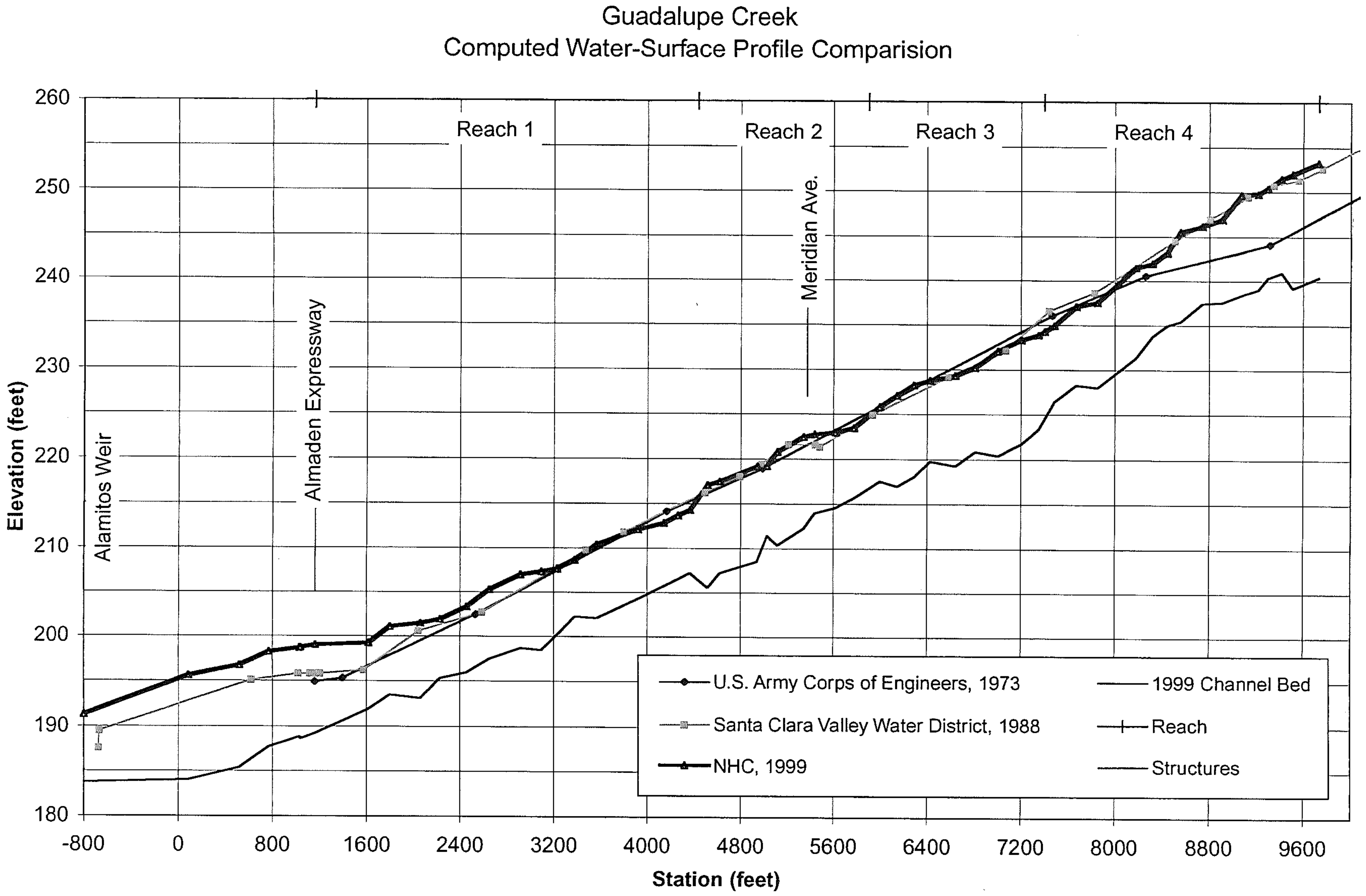
Sediment is transported in the creek by the flow of water. The term load is used to refer to the rate of sediment in motion in the stream. Bedload is the portion of the load that moves on or near the bed by rolling, saltation, or sliding (Chang 1992). The sediment transport capacity for bedload was calculated for each reach and compared with other reaches in the project area to evaluate the stability of the streambed. The bedload transport can be estimated from the channel and streamflow characteristics, which include particle sizes within the bed, width of the moveable bed, flow depth, channel velocity, and energy slope. In general, the flow depth, channel velocity, and energy slope increase with increasing discharge.

Sediment Sources. Sediment is supplied to the creek though mass wasting and erosion processes within the basin. Steep slopes and the highly erodible composition of the Franciscan Complex geologic unit in the drainage basin above Camden Avenue serve as the primary supply of sediment to the creek.

Guadalupe Reservoir has an impact on the sediment supply to Guadalupe Creek. Sediment produced in the area tributary to Guadalupe Reservoir is trapped behind Guadalupe Dam, reducing the sediment producing area of the Guadalupe drainage basin by approximately half. Likewise, flows are significantly reduced as a result of the storage capacity within the reservoir. The net effect of the reservoir on the basin is to reduce the sediment transport potential and sediment supply when there is storage capacity in the reservoir. When the reservoir is full and flows overtop the spillway, the sediment transport potential will increase but the sediment supply remains reduced downstream from the reservoir.

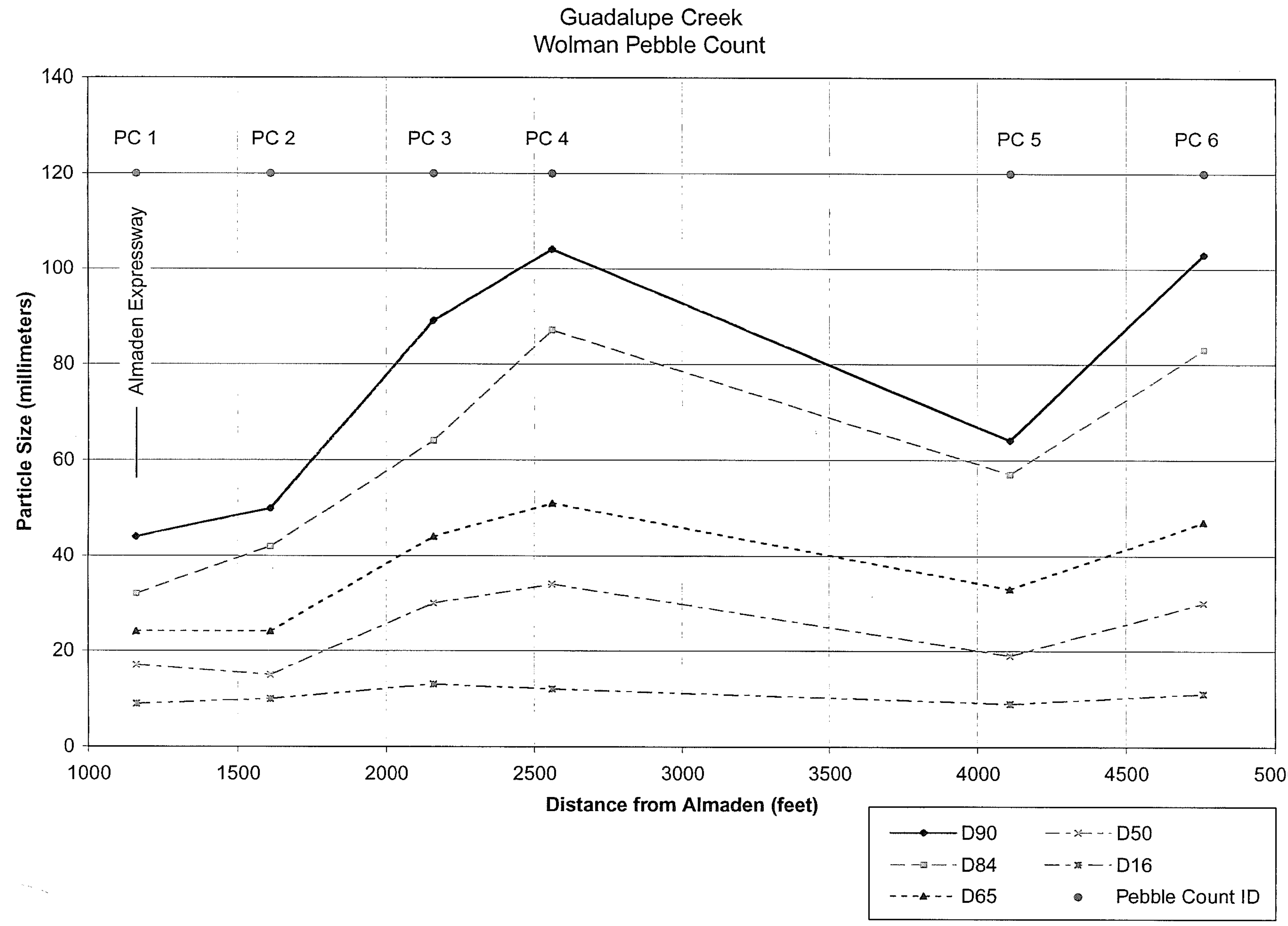
Sediment Characteristics. Wolman pebble counts (Wolman 1954) were collected from bar surfaces at six locations along the project area. These counts were taken from the most prominent depositional features in the project area, the alternating gravel bars located in Reach 1. The approximate locations of the samples are shown on the site maps in Appendix B. Figure 3-25 shows a plot of particle sizes at the sampled sites. Smaller scale depositional features with weakly cemented cobble gravel surfaces were found in Reaches 2, 3, and 4. These features may only become active during large events. Visual field inspection found the bed material to range from fine gravel to very coarse gravel in Reach 1 to an armor layer consisting of large gravel and cobble in Reach 4. Pebble count 4 at station 25+60 was used for Reaches 1–4 as a representative bedload gradation for sediment transport capacity computations.

Field Observations. Channel conditions were mapped in the site inventory work conducted in November, 1999, and are described in Section 3.1. In general, the planform of the channel appears to be relatively stable with few areas of significant channel migration. Sinuosity of the channel is low, with few well-developed meanders in the project area. Several areas of bank erosion



Jones & Stokes
nhc

Figure 3-24
Computed 100-Year Water-Surface Profile Comparison



NOTE: D*x* is the particle size (diameter in millimeters) that is equal to or greater than *x* percent of the particles.

Jones & Stokes
nhc

Figure 3-25
Pebble Count Particle Sizes

are present, including some that threaten adjacent infrastructure, and in many areas the lower bank is steep or nearly vertical. However, bank erosion rates appear to be low due to resistant bank materials and the presence of vegetation on the upper bank.

The bed profile comparison described in Section 3.1 indicates channel incision has occurred relatively recently in Reaches 2 through 4. This comparison matches field observations that existing drainage outlet structures and concrete slope protection are undercut 2-4 feet. Unfortunately, dates of construction and original bed elevations at these structures are not presently available. However, the current form of the channel, including the low amount of fine-grained channel deposits and large bed material sizes indicate that the channel still has potential to degrade, especially in Reach 4.

The area immediately upstream from Almaden Expressway has large alternate bars, and the appearance of an aggradational trend. However, the profile comparison indicates relative stability for Reach 1 for the period from 1972 to 1999. Hydraulics at the bridge opening are affected by the structure and by vegetation immediately downstream from the bridge. In addition, this area is subject to backwater during periods of high flow in Alamitos Creek and Guadalupe River. Additional analysis of the bridge opening and the area immediately upstream will be completed in final design to design project features and identify maintenance requirements to maintain adequate hydraulic capacity through the bridge opening.

Sediment Continuity. The relative differences between sediment transport capacities of reaches can be used to evaluate channel trends and stability. This technique, referred to as sediment continuity routing, identifies changes or breaks in sediment transport between reaches that could lead to aggradational or degradational trends. The sediment continuity between reaches for Guadalupe Creek was estimated by calculating a mass balance of sediment into and out of each reach. The difference between the sediment transport capacity of a reach and that of the reach upstream is used as an indicator to determine if the reach has the potential to aggrade or degrade.

Sediment transport capacities are calculated by multiplying the sediment transport potential for a given grain size by the percent of that size class in the bed. The Hydraulic Design Package for Channels (SAM) (Waterways Experiments Station 1998) was used to compute the transport capacities. This method of assessing sediment transport potential provides a qualitative approach to reviewing the sediment continuity for the project. However, computed capacities should not be interpreted as actual transport rates, as the method does not explicitly include sediment supply, bed change during an event, bed sorting and armoring, or existence of bed control.

Selection of Transport Function. A bedload function was selected to estimate transport rates for each reach within the project area. Measured bedload data and suspended load data from which bedload rates might be estimated were not available for Guadalupe Creek. Three bedload equations that were developed for gravel bed rivers were initially applied to the reaches: Einstein bed-load function (1950), Meyer-Peter-Muller function (MPM) (1948), and Profitt-Sutherland (1983). The MPM function was found to compute loads that fell between the Einstein and Proffitt-Sutherland functions. Based on these results, the MPM function was used to compute transport capacities of Guadalupe Creek for a range of discharges. The use of the MPM function for the bedload is consistent with the Upper Guadalupe River HEC-6 model (Phillip Williams & Associates 1993), which used the MPM-Toffaleti combined grain-size function.

Results. Transport capacities at discrete flows were computed for each reach and plotted in Figure 3-26. A decreasing trend in transport capacity in the downstream direction is apparent for each flow in this figure. Reaches 2 and 3 have relatively similar transport capacities for the range of flows. Relative differences between the reach-averaged transport capacities are more pronounced at the higher peak flows, the 50- and 100-year peak flows, than at the lower flows. The relative magnitudes computed for the range of flows suggest that the less frequent larger events (i.e., 10-year return period and up) presently have a greater effect on channel changes than the more frequent smaller flow events.

These results correlate well with the results of the geomorphic analysis, as described in Section 3.1. Reach 1 is apparently the most stable reach in the profile for the period 1972–1999. This reach has the lowest sediment transport capacity. Reach 4, with the highest sediment transport capacity, has the most entrenched channel form and highest level of channel bed degradation since 1972. The results suggest that channel incision in Reaches 2–4 could be reduced by reducing sediment transport potential in these three reaches to more closely match that in Reach 1.

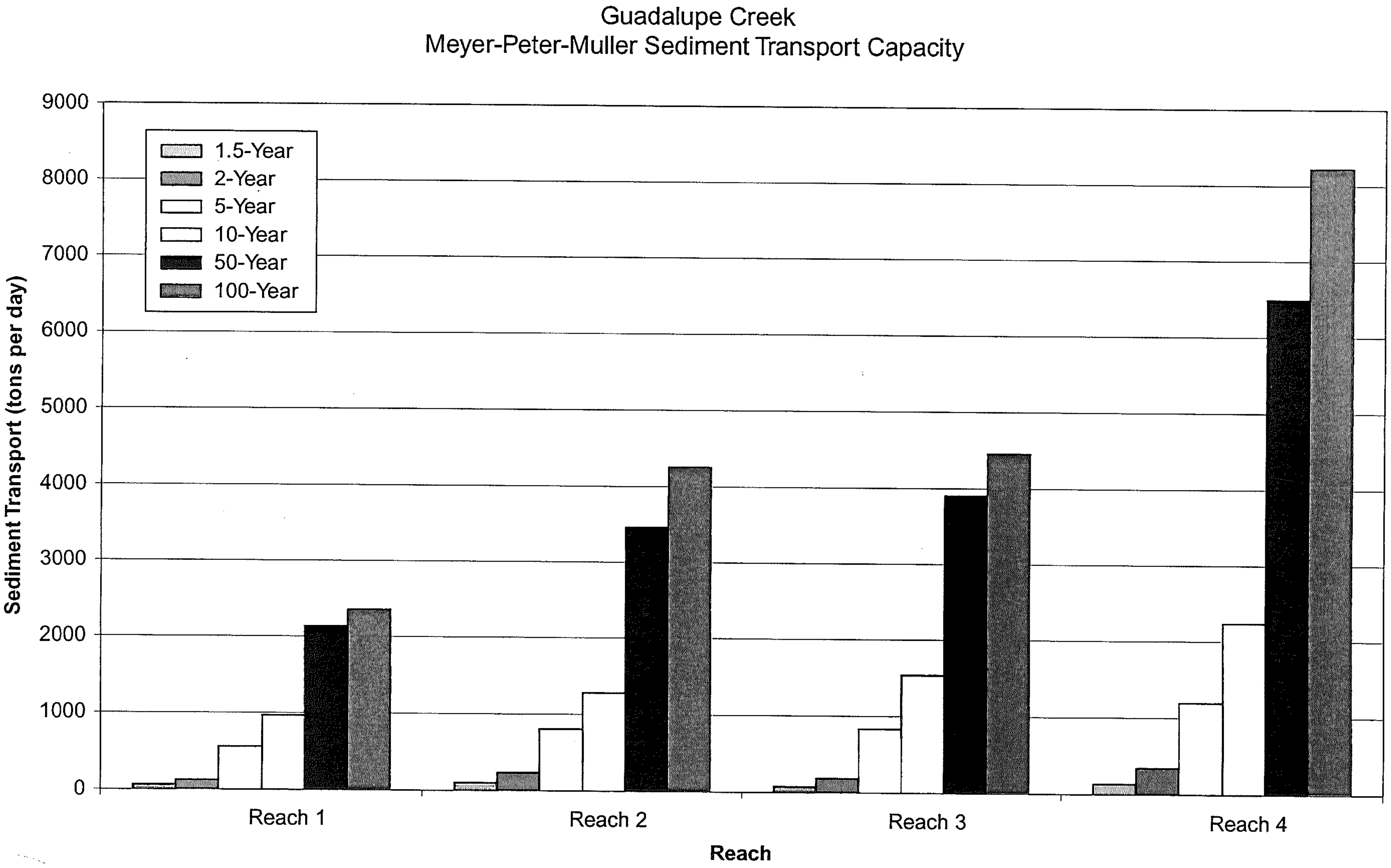
Additional sediment transport computations will be completed during the final design phase of the project to estimate sediment supply from upstream, to more closely balance sediment transport capacities between reaches and guide design of the channel/floodplain geometry.

3.2 SOILS AND GROUNDWATER HYDROLOGY

At the most basic level, soil serves as a rooting medium and as a source of water and nutrients for plant growth. Consequently, soil characteristics can significantly influence the suitability of a specific location within the project area for riparian habitat restoration. Since most woody riparian species require direct access to groundwater for at least part of the year, local groundwater hydrology can also significantly influence habitat restoration suitability. The objective of this portion of the document is to identify and discuss the soil and groundwater conditions that are most likely to influence habitat restoration suitability and restoration design within the project area. An emphasis is placed on identifying conditions that will likely constrain restoration efforts.

3.2.1 Soils

A review of site-specific soil data gathered during field visits in November 1999 and February 2000 indicates that the two soil features most likely to influence the restoration suitability of the project area are texture and the presence of potentially root-restrictive subsoil horizons. These soil characteristics and the mechanisms by which they can influence restoration suitability are listed below.



Jones & Stokes
nhc

Figure 3-26
Sediment Transport Capacities

1. High sand and coarse fragment content: Soils with high sand and course fragment content generally have low available water-holding capacities (AWHC), which limits their ability to supply water to plants. Coarse fragments can physically inhibit root penetration if present in high quantities. Sandy soils with high coarse fragment contents occur at various depths in all nine soil map units.

2. Presence of fine-textured subsoil horizons with hard to extremely hard consistency (when dry): These horizons may physically restrict root penetration and limit subsoil permeability, both of which may limit plant growth and survival. Hard subsoil horizons occur most frequently in Soil Map Unit B.

3. Presence of moderately cemented subsoil horizons: These horizons may limit plant growth by restricting root penetration in the subsoil and may impede lateral movement of water from the creek into adjacent soils and sediments. Localized areas of moderately cemented subsoil horizons occur mostly in Soil Map Unit D.

The degree to which each of these soil parameters is expected to influence restoration suitability in each of the nine map units is expressed on a relative scale in Table 3-8. For example, high sand and coarse fragment content is expected to constrain restoration efforts in Soil Map Unit C more than in Soil Map Unit B. Depth to groundwater, which also appears as a potential constraint in Table 3-8, is discussed below.

Soils located upstream from the project area between Masson Dam and Camden Avenue are similar to the soil in Soil Map Unit A and generally have fewer potential constraints than most of the soil types located within the project area. These soils contain thicker medium- and fine-textured surface soil horizons than many of the soils in the project area and lack hard and cemented subsurface soil horizons.

3.2.2 Groundwater Hydrology

The primary method used to investigate groundwater conditions in the project area and in the upstream area between Masson Dam and Camden Avenue involved measuring:

- groundwater elevations in soil test pits,
- ground-surface elevations at soil test pit locations, and
- surface-water elevations in the main channel next to the soil test pits.

Measurements were taken during site visits in November 1999, February 2000, and March 2000 and used to characterize the shape of and depth to the local water table as it extends laterally from the main channel of Guadalupe Creek.

In addition to these activities, piezometers installed in selected soil test pits during the site visits mentioned above are being monitored on a monthly basis and will be used to track groundwater elevations at various distances from the main channel throughout the year.

3.2.2.1 Project Area

The depth to the water table in soil test pits located within the project area (soil test pits S1–S28) was measured during field visits on November 17–19, 1999, and February 18, 2000. Ground-surface elevations at these soil test pit locations and surface-water elevations in the main channel adjacent to these soil test pits were measured on November 18-24, 1999, February 24, 2000, and March 9, 2000, using conventional surveying methods.

Groundwater and surface elevation data for the project area are presented in Table 3-9. In most of the project area, the data indicate that groundwater elevations decrease significantly relative to surface-water elevations with increasing distance from the main channel (i.e., the groundwater profile is "losing" along most of the project area). Examples of losing groundwater profiles are shown for linearly arrayed soil test pits in Figures 3-27 and 3-28. The gradient of the losing groundwater profile within 85 feet of the main channel averages approximately 13% but is generally steeper in the downstream sections of the project area (e.g., Reaches 1 and 2) than in the upstream sections (e.g., Reach 4).

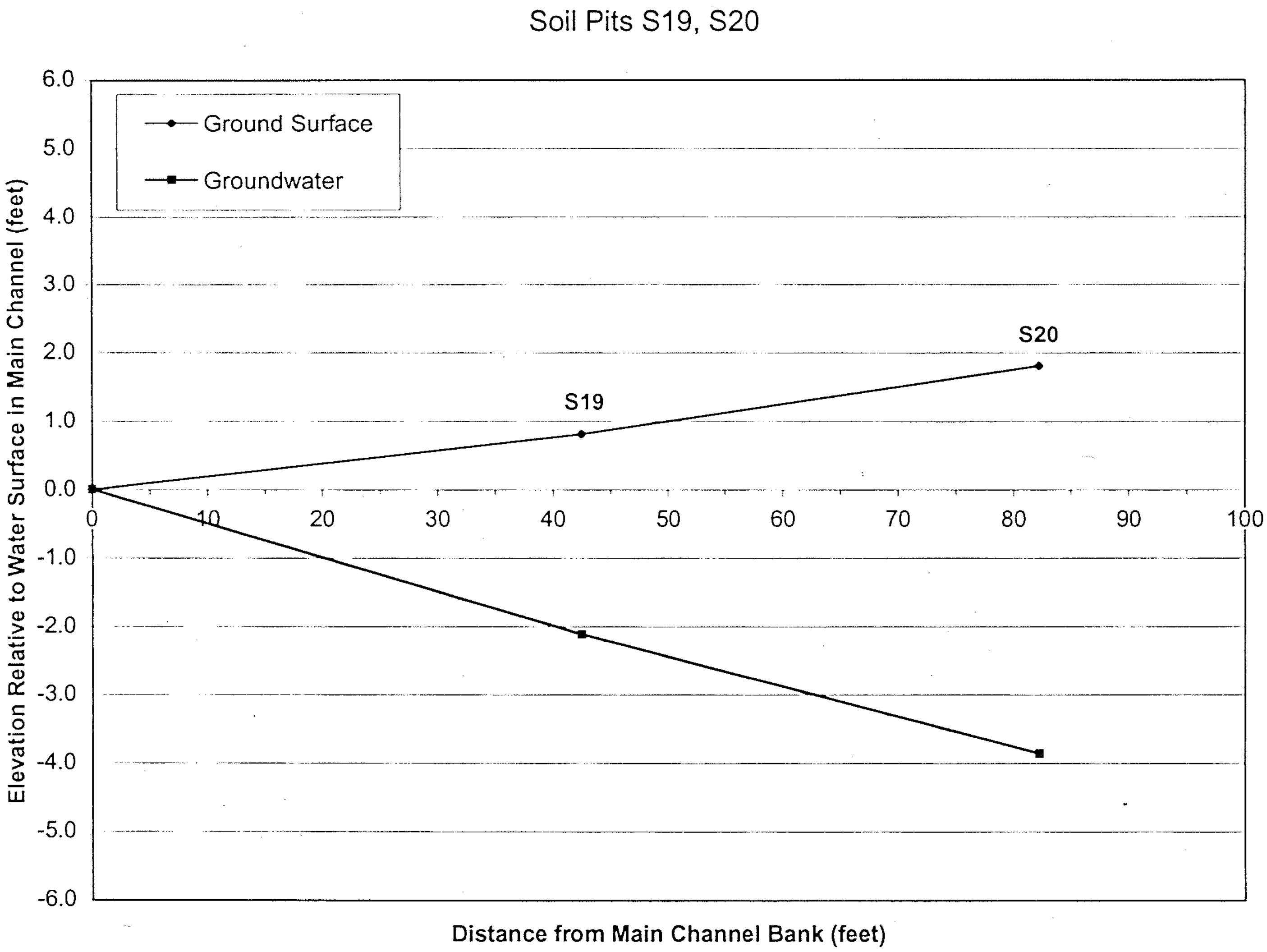
In some sections of the project area, groundwater elevations increase, remain nearly level, or increase slightly relative to surface-water elevations with increasing distance from the main channel (i.e., the groundwater profile is level or slightly "gaining"). The data indicate that level and slightly gaining groundwater profiles occur primarily in Reach 3 (Appendix A, Baseline Soil Map, Sheets 8 and 9). Examples of a relatively level groundwater profile and a slightly gaining groundwater profile are shown in Figures 3-29 and 3-30, respectively.

Ground-surface elevations increase with increasing distance from the main channel along the entire project area (Table 3-9, Figures 3-27–3-30). Consequently, the depth to groundwater can be significant in both losing reaches and gaining reaches and is a significant restoration constraint throughout the project area. However, depth to groundwater can be expected to be a relatively greater constraint along reaches where losing groundwater profiles exist.

Groundwater elevation monitoring data collected from piezometers located within the project area are limited because relatively little time has past since the piezometers were installed in November 1999 and February 2000. Therefore, these data were not included in this report. They will be included at a later date when more data are available.

3.2.2.2 Upstream Area between Masson Dam and Camden Avenue

Losing groundwater profiles also predominate in the upstream area between Masson Dam and Camden Avenue (Table 3-10). However, losing groundwater profile gradients in the upstream



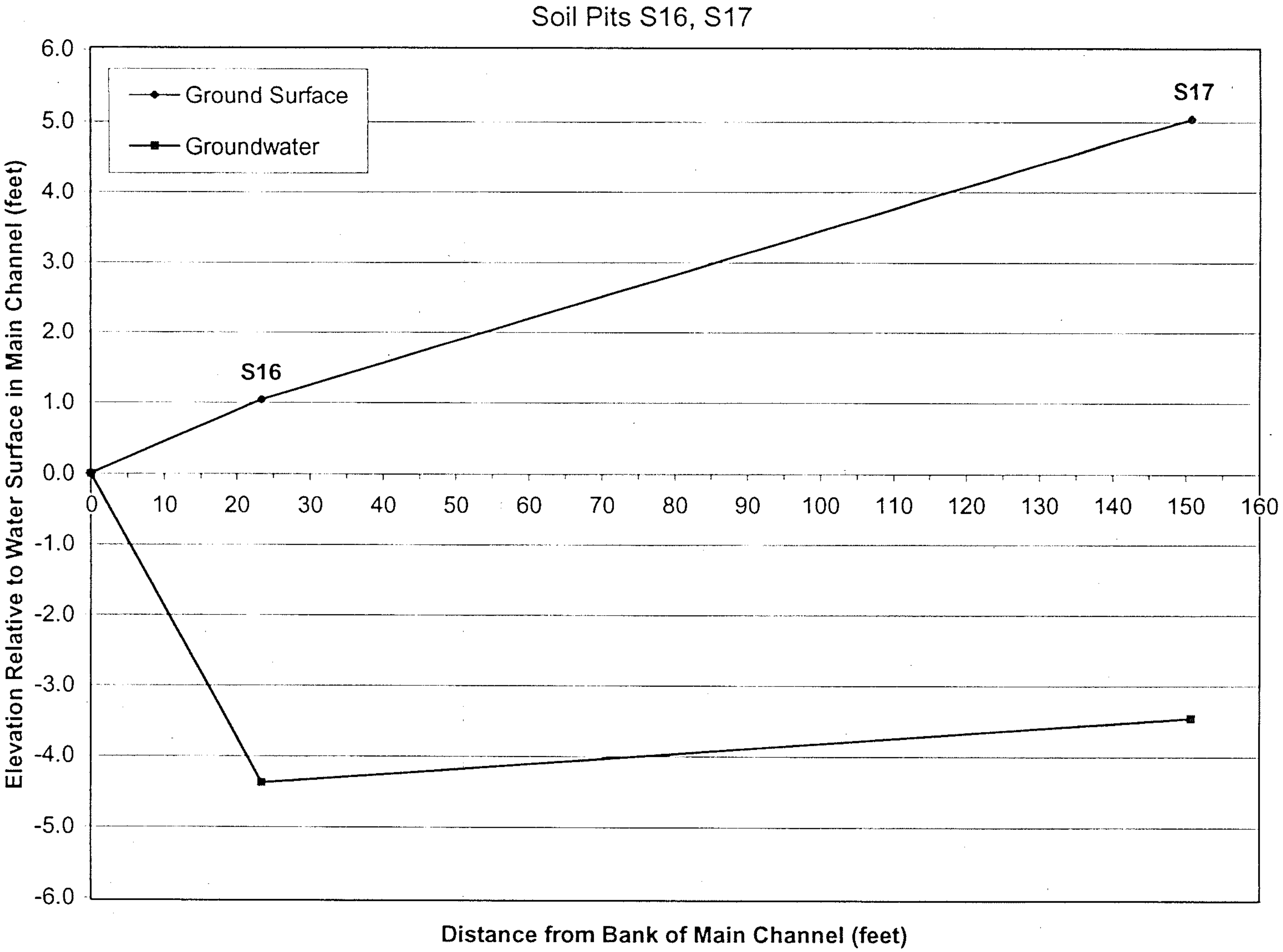
Notes:

Elevations are relative to the water surface in the main channel of Guadalupe Creek.
Groundwater elevations were measured on November 17–19, 1999.
Surface-water elevations were measured on November 18–24, 1999.

Jones & Stokes
nhc

Figure 3-27

Relative Ground-Surface and Groundwater Elevations at Soil Test Pits S19 and S20

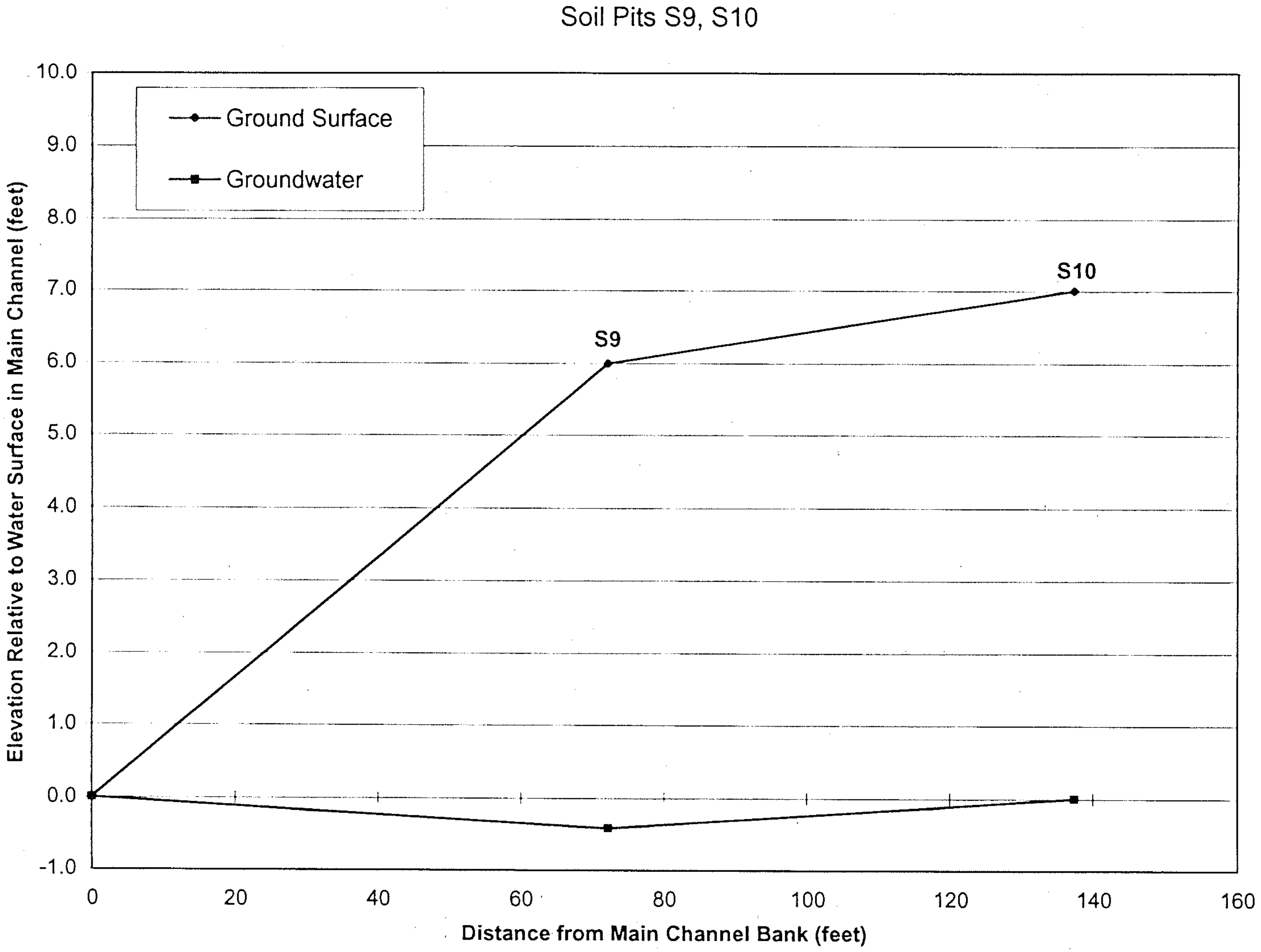


Notes:

Elevations are relative to the water surface in the main channel of Guadalupe Creek.
Groundwater elevations were measured on November 17–19, 1999.
Surface-water elevations were measured on November 18–24, 1999.

Jones & Stokes
nhc

Figure 3-28
Relative Ground-Surface and Groundwater Elevations at Soil Test Pits S16 and S17

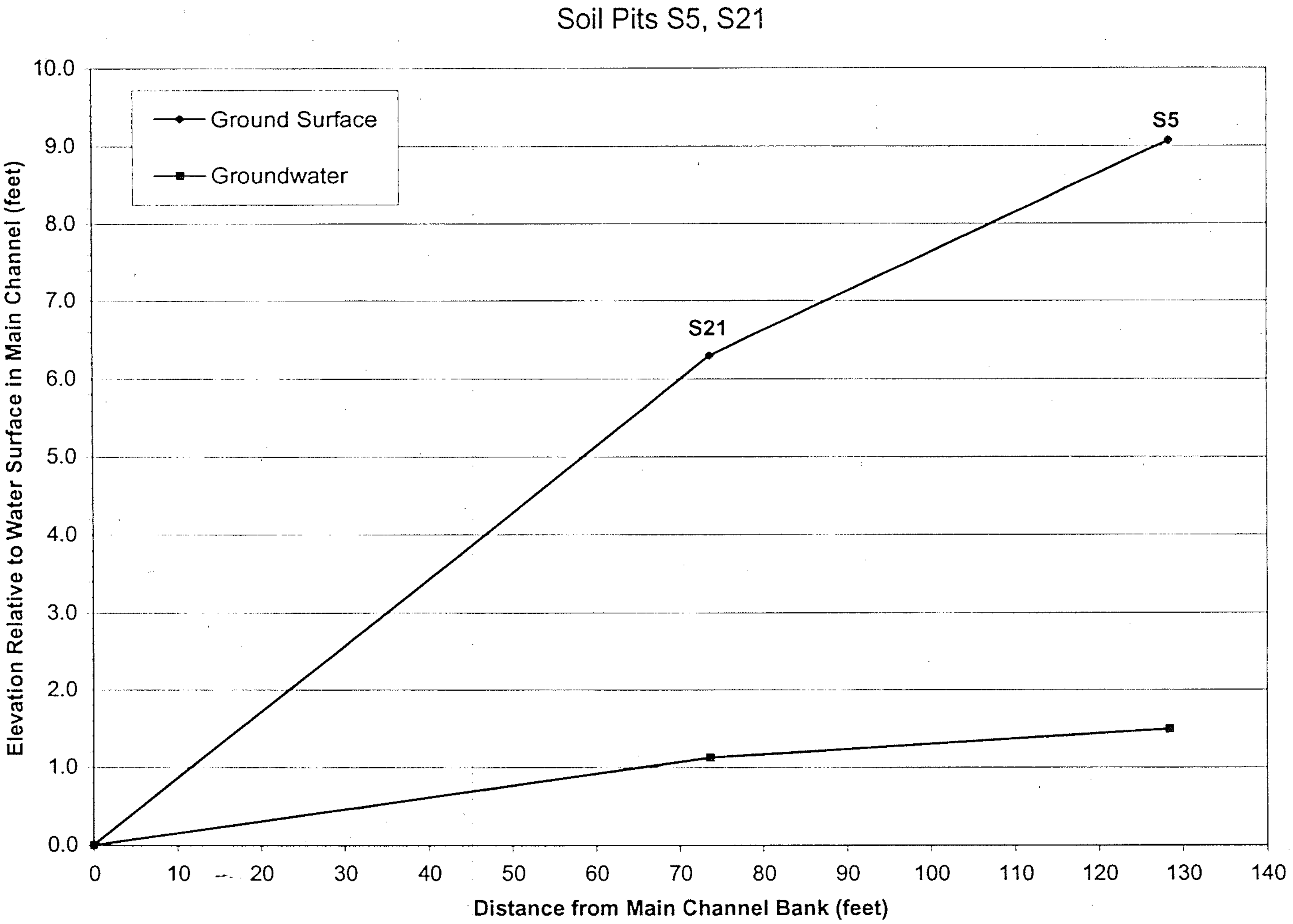


Notes:

Elevations are relative to the water surface in the main channel of Guadalupe Creek.
Groundwater elevations were measured on November 17–19, 1999.
Surface-water elevations were measured on November 18–24, 1999.

Jones & Stokes
nhc

Figure 3-29
Relative Ground-Surface and Groundwater Elevations at Soil Test Pits S9 and S10



Notes:

Elevations are relative to the water surface in the main channel of Guadalupe Creek.
Groundwater elevations were measured on November 17–19, 1999.
Surface-water elevations were measured on November 18–24, 1999.

Jones & Stokes
nhc

Figure 3-30
Relative Ground-Surface and Groundwater Elevations at Soil Test Pits S5 and S21

Table 3-8. Potential Soil and Hydrologic Constraints of Soil Map Units Located within the Guadalupe Creek Project Area

Soil Map Unit	Potential Constraint	Relative Constraint Level
A, deep groundwater phase	Depth to groundwater table	3
	High sand and coarse fragment content	2
	Fine-textured subsoil with hard consistence	1
	Localized, moderate subsoil cementation	0
B	Depth to groundwater table	2
	High sand and coarse fragment content	1
	Fine-textured subsoil with hard consistence	2
	Localized, moderate subsoil cementation	1
Bd, deep groundwater phase	Depth to groundwater table	3
	High sand and coarse fragment content	2
	Fine-textured subsoil with hard consistence	2
	Localized, moderate subsoil cementation	1
C	Depth to groundwater table	1
	High sand and coarse fragment content	2–3
	Fine-textured subsoil with hard consistence	0
	Localized, moderate subsoil cementation	0
Cd, deep groundwater phase	Depth to groundwater table	3
	High sand and coarse fragment content	2–3
	Fine-textured subsoil with hard consistence	0
	Localized, moderate subsoil cementation	0
Cc, cobbly surface phase	Depth to groundwater table	1
	High sand and coarse fragment content	3
	Fine-textured subsoil with hard consistence	0
	Localized, moderate subsoil cementation	0
D	Depth to groundwater table	1
	High sand and coarse fragment content	2
	Fine-textured subsoil with hard consistence	1
	Localized, moderate subsoil cementation	0–1
Dd, deep groundwater phase	Depth to groundwater table	3
	High sand and coarse fragment content	2
	Fine-textured subsoil with hard consistence	1
	Localized, moderate subsoil cementation	0–1
E	Depth to groundwater table	V
	High sand and coarse fragment content	1–3
	Fine-textured subsoil with hard consistence	V
	Localized, moderate subsoil cementation	V

Notes:

0 = none.
1 = low.
2 = moderate.
3 = high.
V = variable.

Table 3-9. Summary of Groundwater, Surface-Water, and Ground-Surface Elevational Data for Soil Test Pits and Piezometers Located within the Guadalupe Creek Project Area

Soil Test Pit Number	Piezometer Number	Map Sheet Number	Project Reach Number	Distance between Soil Test Pit/ Piezometer and Bank of Main Channel (feet)[a]	Ground-Surface Elevation (feet above MSL)[b,c]	Groundwater Elevation (feet above MSL)[d]	Surface-Water Elevation (feet above MSL)[e,f]	Depth to Groundwater (feet)[f]	Relative Groundwater Elevation (feet)[g]	Relative Ground-Surface Elevation (feet)[g]	Relative Groundwater Profile Gradient (percent)[h]
S1	P1	12	4	ND	ND	ND	ND	9.7	ND	ND	ND
S2	P2	11	4	84.7	243.5	234.0	235.7	9.5	-1.7	7.8	-2.5
S3	P3	11	4	66.3	249.0	238.6	240.8	10.3	-2.1	8.2	-3.2
S4	P4	10	3	55.4	236..9	227.0	229.8	9.9	-2.8	7.1	-5.1
S5	-	9	3	128	233.1	225.5	224.0	7.6	1.5	9.1	1.2
S6	P5	8	3	30.1	227.0	222.8	221.4	4.3	1.3	5.6	4.5
S7	P6	8	3	132	228.3	223.1	221.4	5.3	1.7	6.9	ND
S8	P7	8	3	196	228.7	222.7	221.4	5.9	1.3	7.3	ND
S9	-	8	3	72.2	225.2	218.7	219.2	6.4	-0.4	6.0	-0.6
S10	-	8	3	137	226.2	219.2	219.2	7.0	0.0	7.0	ND
S11	P8	5	1	19.1	210.6	205.3	207.8	5.3	-2.6	2.8	-13.4
S12	-	4	1	28.8	211.0	202.8	205.0	8.2	-2.1	6.0	-7.4
S13	-	3	1	28.3	201.1	194.6	200.0	6.5	-5.4	1.1	-19.1
S14	-	3	1	12.8	199.5	194.3	197.9	5.3	-3.7	1.6	-28.6
S15	-	2	1	9.38	197.0	191.4	194.4	5.6	-3.0	2.6	-31.8
S16	P9	2	1	23.4	195.0	189.6	194.0	5.4	-4.4	1.0	-19.0
S17	P10	2	1	150	199.0	190.5	194.0	8.5	-3.5	5.0	ND
S18	-	4	1	15.4	204.2	199.3	202.7	4.9	-3.4	1.5	-22.3
S19	-	1	1	42.5	191.5	188.6	190.7	2.9	-2.1	0.8	-4.7
S20	-	1	1	82.2	192.5	186.8	190.7	5.7	-3.9	1.8	-5.0
S21	-	9	3	73.7	230.3	225.1	224.0	5.2	1.1	6.3	1.5
S22	P11	1	1	31.54	193.9	188.4	193.2	5.5	-4.8	0.7	-15.2
S23	P12	1	1	60.0	197.6	189.1	194.0	8.5	-4.9	5.6	ND

Table 3-9. Continued

Soil Test Pit Number	Piezometer Number	Map Sheet Number	Project Reach Number	Distance between Soil Test Pit/ Piezometer and Bank of Main Channel (feet)[a]	Ground-Surface Elevation (feet above MSL)[b,c]	Groundwater Elevation (feet above MSL)[d]	Surface-Water Elevation (feet above MSL)[c,f]	Depth to Groundwater (feet)[f]	Relative Groundwater Elevation (feet)[g]	Relative Ground-Surface Elevation (feet)[g]	Relative Groundwater Profile Gradient (percent)[h]
S24	P13	1	1	ND	ND	ND	ND	ND	ND	ND	ND
S25	P14	3	1	10.0	203.4	198.4	200.0	5.0	-1.6	3.4	-16.0
S26	P15	6	2	14.0	213.3	209.8	211.7	3.5	-1.9	1.6	-14.0
S27	P16	7	2	14.0	218.4	214.8	216.4	3.6	-1.6	2.0	-11.0
S28	P17	11	4	ND	ND	ND	ND	ND	ND	ND	ND

Notes:

[a] Measured on baseline soil maps (Exhibit 2).

[b] MSL = mean sea level.

[c] Elevations were surveyed by Northwest Hydraulic Consultants (NHC) using conventional survey methods or estimated using topographic contours on baseline soil maps (Exhibit 2).

[d] Calculated values based on ground-surface elevation measurements taken by NHC and groundwater depth measurements taken by Jones & Stokes.

[E] Surface-water elevations for soil test pits S1–S22 were measured by NHC November 18-24, 1999, using conventional survey methods. Surface-water elevations for soil test pits S23–S28 were measured by NHC on March 9, 2000, using conventional survey methods.

[f] Groundwater depths in soil test pits S1–S22 were measured by Jones & Stokes on November 17-19, 1999. Groundwater depths in soil test pits S23-S28 were measured by Jones &Stokes on February 18, 2000.

[g] Elevation relative to water surface in creek.

[h] Where linearly arrayed soil test pits occur, only the groundwater profile gradient between the main channel and the closest test pits in the array was reported, unless the groundwater levels in test pits located farther from the main channel were significantly different. For example, soil test pits S16 and S17 (Figure 3-28) were linearly arrayed, but groundwater level in S17 did not differ significantly from that in test pit S16. Consequently, only the gradient between the main channel and test pit S16 was reported. Conversely, groundwater elevations in test pits S19 and S20 differed significantly, so both gradients were reported.

ND = Not determined.

Table 3-10. Summary of Groundwater, Surface-Water, and Ground-Surface Elevational Data for Soil Test Pits and Piezometers Located Upstream from the Guadalupe Creek Project Area between Masson Dam and Camden Avenue

Soil Test Pit Number	Piezometer Number	Distance between Soil Test Pit/ Piezometer and Bank of Main Channel (feet)[a]	Ground-Surface Elevation (feet above MSL)[b,c]	Groundwater Elevation (feet above MSL)[b,d]	Surface-Water Elevation (feet above MSL)[b,c,e]	Depth to Groundwater (feet)[f]	Relative Groundwater Elevation (feet)[g]	Relative Ground-Surface Elevation (feet)[g]	Relative Groundwater Profile Gradient (percent)[h]
1	1	73.9	275.1	271.1	ND	4.0	ND	ND	ND
2	2	81.0	270.8	264.7	264.8	6.1	-0.1	6.0	-0.1
3	3	98.6	273.7	267.2	ND	6.5	ND	ND	ND
4	4	63.4	269.9	265.1	265.6	4.8	-0.5	4.3	-0.8
5	5	35.2	263.5	258.4	260.5	5.1	-2.1	3.0	-6.0
6	6	88.0	265.1	259.8	260.2	5.3	-0.3	4.9	ND
7	7	73.9	255.6	250.4	252.4	5.2	-1.9	3.2	-2.6
8	8	161.9	255.6	250.6	252.7	4.9	-2.0	2.9	ND

Notes:

[a] Measured on aerial photograph (scale 1 inch ≈350 feet).

[b] MSL = mean sea level.

[c] Elevations were surveyed by Northwest Hydraulic Consultants (NHC) using conventional survey methods.

[d] Calculated values based on ground-surface elevation measurements taken by NHC and groundwater depth measurements taken by Jones &Stokes.

[e] Surface-water elevations were measured by NHC on February 24, 2000.

[f] Groundwater depths in soil test pits 1–8 were measured by Jones & Stokes on February 18, 2000.

[g] Elevation relative to water surface in creek.

[h] Where linearly arrayed soil test pits occur, only the groundwater profile gradient between the main channel and the closest test pits in the array was reported, unless the groundwater levels in test pits located farther from the main channel were significantly different. For example, soil test pits S16 and S17 (Figure 2) were linearly arrayed, but groundwater level in S17 did not differ significantly from that in test pit S16. Consequently, only the gradient between the main channel and test pit S16 was reported. Conversely, groundwater elevations in test pits S19 and S20 differed significantly, so both gradients were reported.

ND = Not determined.

area are significantly lower than those in the project area. This difference may in part explain the nearly contiguous growth of riparian vegetation in the upstream area when compared to the project area.

Groundwater elevation monitoring data collected from piezometers located upstream from the project area are limited because relatively little time has expired since their installation in February 2000. Therefore, they were not included in this report. They will be included at a later date when more data are available.

3.3 VEGETATION

3.3.1 Historic Vegetation

3.3.1.1 Data Sources

Information for this portion of the document was obtained from historical aerial photographs (Table 3-1), historical topographic maps (Table 3-2), historical survey field notes, and literature cited in Chapter 9, "Citations". Copies of plat maps and field notes from the Public Lands Survey of the 1860s and 1870s were obtained from the California State Library. In particular, the field notes for the surveys of the Rancho de San Juan Bautista of 1860 and Rancho Cañada de Capitancillos of 1871 were of interest. A description of historic geomorphic and land use changes is presented in Section 3.1.1.4., "Historical Geomorphology".

3.3.1.2 Presumed Pre-European Riparian Vegetation

The extensive modification of the landscape along the project area prior to the availability of aerial photographs makes any inference about the pre-European vegetation condition very difficult to verify. A conceptual reconstruction of the pre-European condition was based on observation of the current vegetation, comparison of the project area with less disturbed riparian vegetation in the region, and 19th century survey notes and maps.

Lower Guadalupe Creek flowed intermittently over an alluvial fan deposited on the valley floor on coarse-grained alluvium. The 1871 land survey and aerial photographs of 1939 and 1948 show that the channel was intermittently dry in the project area. Early maps of the area show a widening floodplain at the downstream portion of Reach 1, which had multiple channels and a broad channel bed in 1871 (Section 3.1.1.4., " Historical Geomorphology"). The riparian tree canopy is dominated by widely spaced western sycamore *(Platanus racemosa)* and valley oak (*Quercus lobata*) trees. Sub-dominant tree species include arroyo willow, white alder *(Alnus rhombifolia)*, California bay *(Umbellularia californica)*, coast live oak *(Quercus agrifolia)*, Fremont cottonwood (*Populus fremontii*), and valley oak. Small trees include California buckeye (*Aesculus californica*), blue elderberry (*Sambucus mexicana*), red willow, and sandbar willow. Shrubs include mule fat and snowberry *(Symphoricarpos* spp.*)*. This community, canopy structure, and physical environment conform closely to the sycamore alluvial woodland of Holland (1986) and the California sycamore series in Sawyer and Keeler-Wolf (1995).

3.3.1.3 Native American Traditional Resource Management

The riparian vegetation in the project area has been drastically modified by human activities. Prior to the Spanish exploration in 1769 and establishment of a mission in San Jose in 1777, native Californians probably substantially modified the vegetation composition and stand structure of the vegetation along lower Guadalupe Creek. The Thamien and Matalan Ohlone tribelets are known to occur in the San Jose area (Margolin 1978). Traditional Resource Management (TRM) was used by the local Ohlone people to tend the Guadalupe Creek landscape prior to European settlement. TRM includes harvesting during specified seasons, replanting, weeding, pruning, aerating the soil through tilling with a digging stick, and limiting harvest. The net result was an open and park-like woodland with lower density between understory plants and long, straight stems on shrubs. Hundred of thousands of sedge rhizomes, grass culms, and straight stems from willow and red bud were needed to make the baskets produced by a single tribelet. A search in the wild for long, straight, slender basketry materials with no lateral branching is largely in vain. In addition to basketry materials, mule fat limbs and branches were pruned to create straight stems for dwelling construction, arrow foreshafts, and fire drills. California buckeye was pruned for arrow shafts. To gain sufficient material to support their cultural needs, the Ohlone people had to manage and maintain abundant populations of certain plants at what was virtually an industrial level.

The Ohlone and other native people extensively used fire as a management tool. The use of fire was the most frequent and effective tool used by California peoples to manage the environment in general and oaks in particular (Harrington 1942, Schenck and Gifford 1952, Kroeber 1925 p. 88). Coast live oak and valley oak are common tree species in the project area that provided acorns for consumption. An average family could eat up to 1,000–2,000 pounds of acorns per year. Leaves of California bay and mugwort (*Artemisia douglasiana*) were layered in acorn granaries to discourage insect predation.

Large acreages of grasslands were often burned over twice to kill the brush. Burning occurred in spring and fall. After burning, seeds were deliberately sowed into the burned area to cultivate growth for the following year. The following spring grasses, berries, and green herbs emerged (Teaford 1930). A staple food in the Ohlone diet was pinole, a porridge composed of grass and herb seeds. Meadows were burned after harvest. Seeds were harvested for pinole from black sage (*Salvia mellifera*), chia (*Salvia columbariae*), wild grasses, wild sunflower (*Helianthus* spp.), evening primrose (*Oenothera* spp.), morning glory (*Convolvulus* spp.), clarkia seeds (*Clarkia* spp.), tarweed (*Madia* and *Hemizonia* spp.), wild cucumber (*Marah fabaceus*), and curly dock (*Rumex crispus*). Redmaid seeds (*Calendrinia ciliata*) were highly favored.

Fire was also used as a traditional tool to stimulate the growth of green shoots in the spring, berry production later in the season, and reduce competition to stimulate geophyte growth and reproduction. Plants harvested for greens included dock (*Rumex* spp.), clover (*Trifolium* spp.), poppy (*Eschscholzia californica*), and miners' lettuce (*Claytonia perfoliata*). Blue elderberries, blackberries (*Rubus ursinus*), wild grapes (*Vitis californica*), currants and gooseberries (*Ribes* spp.), and strawberries (*Fragaria chiloensis*) were gathered, as well as toyon (*Heteromeles arbutifolia*), madrone (*Arbutus menziesii*), and manzanita (*Arctostaphylos* spp.) berries. Bulbs, corms, and tubers of wild onions (*Allium* spp.), mariposa lilies (*Calochortus* spp.), and wild hyacinth (*Brodiaea* spp.) were dug, cooked, and eaten as a delicacy.

3.3.1.4 Early European Settlement

Spanish exploration of the area started in 1769, and the Mission Santa Clara de Asis was established in 1777 in what is now San Jose. Initially, European settlers used the area for sheep and cattle grazing. With the establishment of the Spanish settlers and the introduction of livestock, a large number of nonnative annual plants rapidly colonized grasslands and woodland understories. Wild oats (*Avena fatua*), ripgut grass (*Bromus diandrus*), soft chess (*Bromus hordeaceous*), storks bill (*Erodium* spp.), and other Mediterranean annual grassland plants quickly established, and native grassland species, in particular native bunch grasses, rapidly declined in abundance in grasslands and woodland understories. Trampling and grazing by livestock probably facilitated the decline of native bunch grasses and reduced regeneration of native woody species, including oaks. Reduction of fire frequency due to a decline in fires set by native people and fire suppression are also likely contributors to the decline of native grassland and woodland understory species. Browsing and trampling by sheep and cattle may have reduced cover of woody riparian species.

Guadalupe Creek was surveyed in the land surveys of the 1860s and 1870s, because it formed the boundary between two ranchos. Plat maps and surveyors field notes indicate stands of valley oak and coast live oak on the uplands and scattered stands of willow and western sycamore near the creeks in the area. The survey field notes suggest that sycamore and valley oak trees were widely spaced along the banks of Guadalupe Creek, then mapped as Arroyo Seco de Guadalupe or Arroyo de Los Capitancillos. The Guadalupe Creek was described as a "dry arroyo" in 1865. At a point near the intersection of Hicks and Kennedy Roads, bearing trees for witness posts include a 16-inch-diameter western sycamore at a distance of 61 feet and a 14-inch-diameter sycamore tree at a distance of 27 feet, suggesting a distance of more than 61 feet between western sycamore trees at that point.

3.3.1.5 Twentieth Century Developments

A comparison of a sequence of aerial photographs for 1939, 1948, 1963, 1980, and 1999 shows that the tree canopy along the channel in the project area has remained relatively constant over the last 60 years (Figures 3-31–3-33). Most changes in the tree canopy during that period have been the result of direct disturbance of the vegetation due to construction of bridges, percolation dams and ponds, and gravel mining. By 1939, the natural physical processes that drive riparian plant community dynamics had already been dramatically altered from their natural state as the result of grazing, agricultural development, and upstream diversion of water. Many canopies of large trees present in 1939 can still be observed in the 1999 aerial photographs (Figures 3-31–3-33). Valley oak and western sycamore are long-lived, drought-tolerant species that, once established, may survive for many hundreds of years.

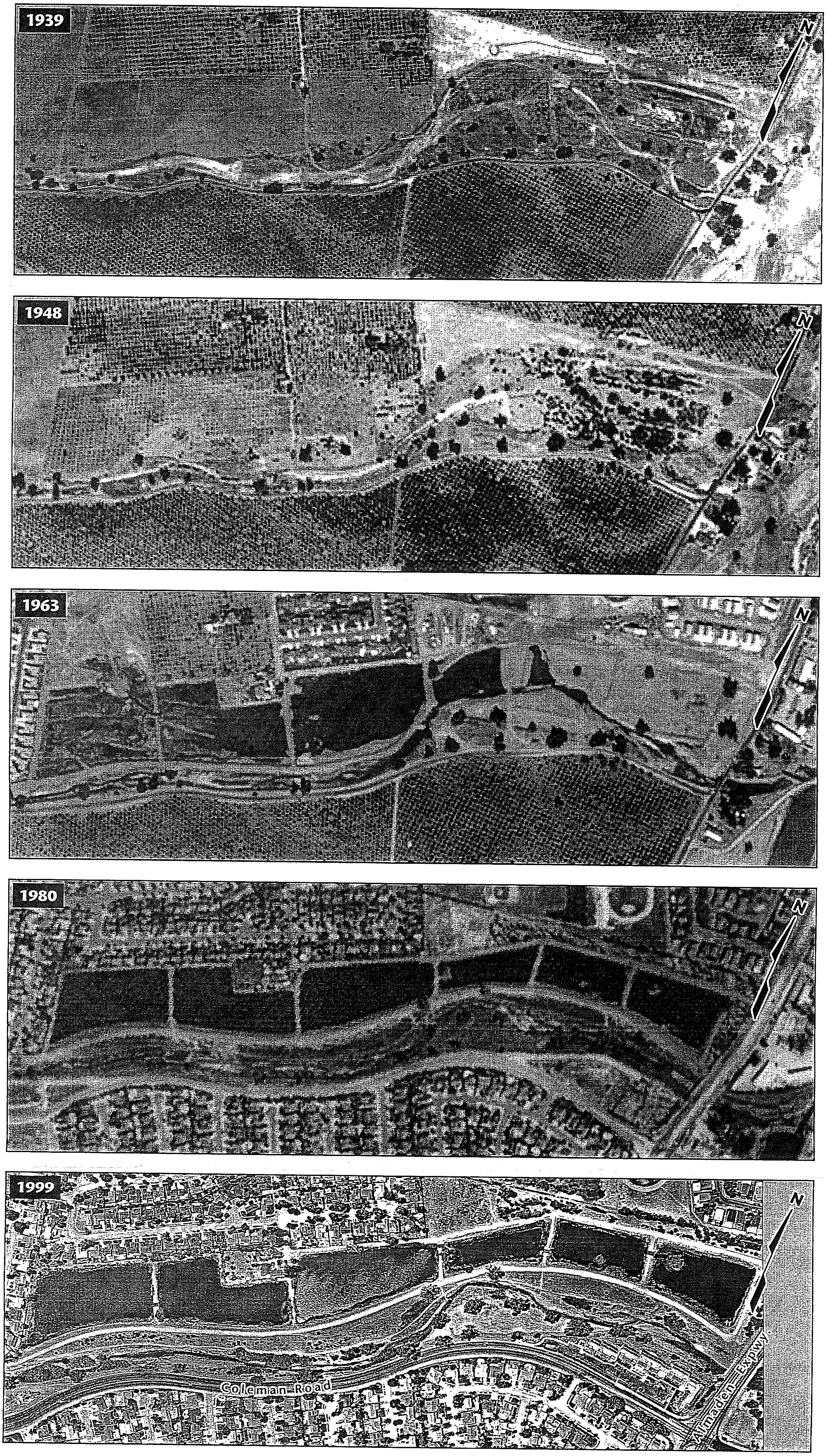
Since 1939, the geomorphic, hydrologic, and hydraulic conditions on which long-term dynamics of the riparian plant communities depend have been further modified by construction of percolation dams, development of the Los Capitancillos percolation pond system, widening of the flood corridor, gravel mining, and urbanization (Section 3.1.1.4. "Historical Geomorphology"). The channel incision associated with diversion and mining has probably affected the riparian understory by lowering the water table. The herbaceous understory has probably shifted to more drought-tolerant species and the regeneration potential of oak, sycamore, and buckeye has probably been reduced. These changes cannot be discerned from large-scale black-and-white aerial photographs.

Under current conditions, the flow in Lower Guadalupe Creek, regulated by Guadalupe Dam, is more constant than 60 years ago, when the flow pattern was more intermittent. Apparently, in response to this change, vegetation along the channel appears to be denser in the 1999 aerial photograph than in the earlier photographs (Figures 3-31–3-33). In particular, dense sandbar willow clones occur both upstream and downstream from the Meridian Avenue Bridge in Reach 2. In addition, many white alder seedlings and some saplings appear to have become established recently along the channel, though few large white alder trees are currently present in the project area. These observations suggest that if establishment sites are created along the channel, including sand bars and low benches, then these species may be expected to increase in cover in the future.

Historically, four gravel spreader dams were placed in Guadalupe Creek for in-channel recharge of groundwater. These dams were made of gravels and finer material to impound water within the channel. The dams were placed in the river in early spring and removed in late fall or winter. From 1986 to 1993, the amount of time the dams remained in place was between 3 and 11 months, with an average of 8 months (Aguilera 2000). The length of creek impounded behind the spreader dams was 4,180 feet (Aguilera 2000). Within Reaches 1 and 2, roughly 80% of the channel was inundated. About 50% of Reach 3 was inundated. Reach 4 did not contain any spreader dams.

The impoundment of water behind the spreader dams can possibly explain some of the natural recruitment patterns observed in Guadalupe Creek. With an average duration of 8 months, the impounded water would kill any seedlings of woody plants that did germinate. The in-channel peculation ponds effectively prevented any natural recruitment within the area of impoundment. This effect can be observed quite clearly at the upstream end of water impoundment of spreader dam 3 (1,300 feet downstream from Meridian Avenue). Large stands of sandbar willow (Appendix A, Baseline Vegetation Map, Sheet 6) have become established, yet have not colonized within the impound area though there are suitable conditions. The same effect can be observed again at cross section 1065 (see Appendix A, Baseline Vegetation Map, Sheet 4). A large patch of willows has established only above the high water of the innundation area.

The District has not operated the spreader dams since 1993 and does not intend to install them in the future. Currently, mule fat and willows are establishing within the areas that were previously inundated. It can be expected that more woody vegetation may establish within these



Jones & Stokes

Figure 3-31
Historical Comparison of Guadalupe Creek Reach 1

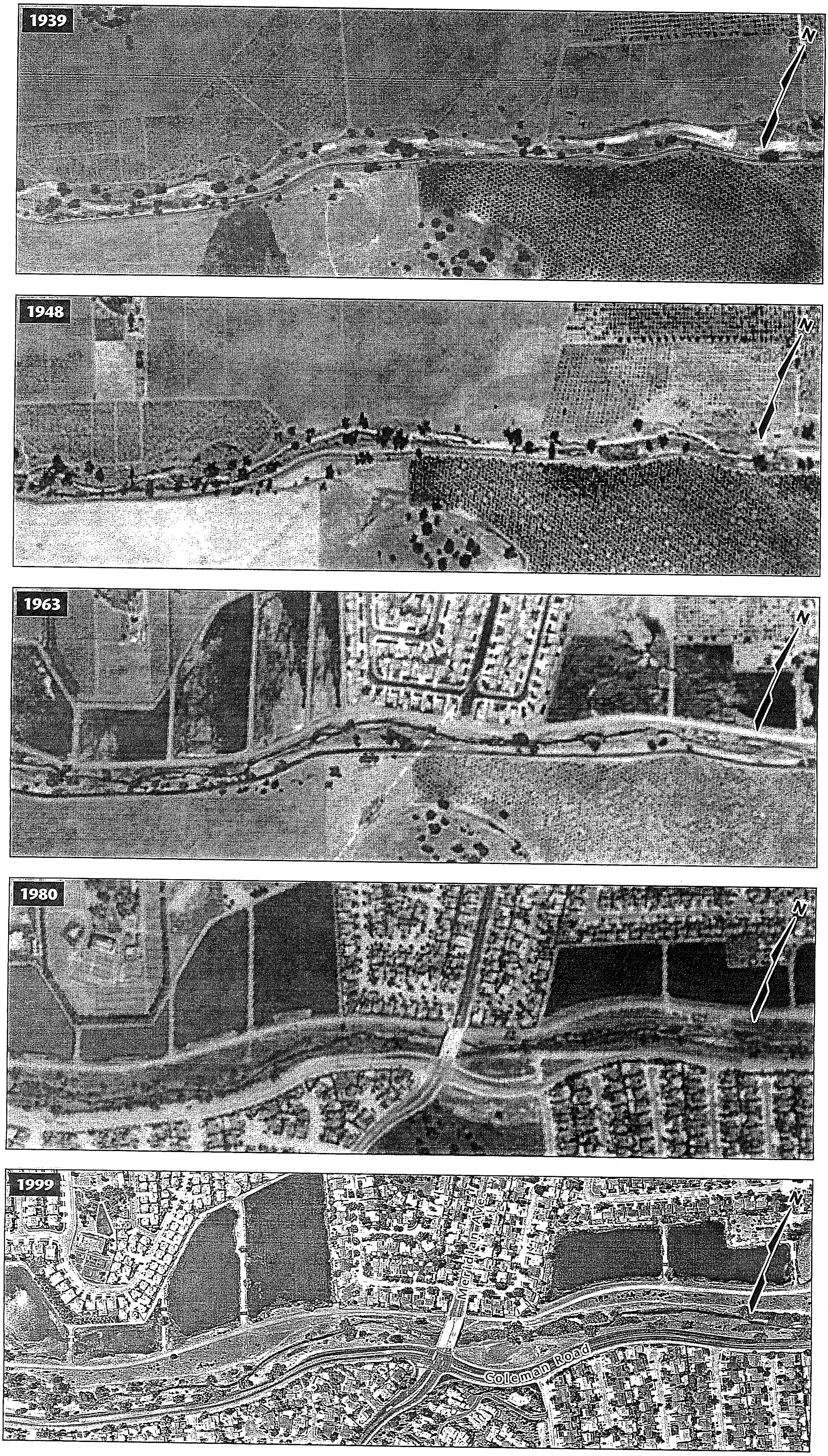


Figure 3-32
Historical Comparison of Guadalupe Creek Reaches 2 and 3

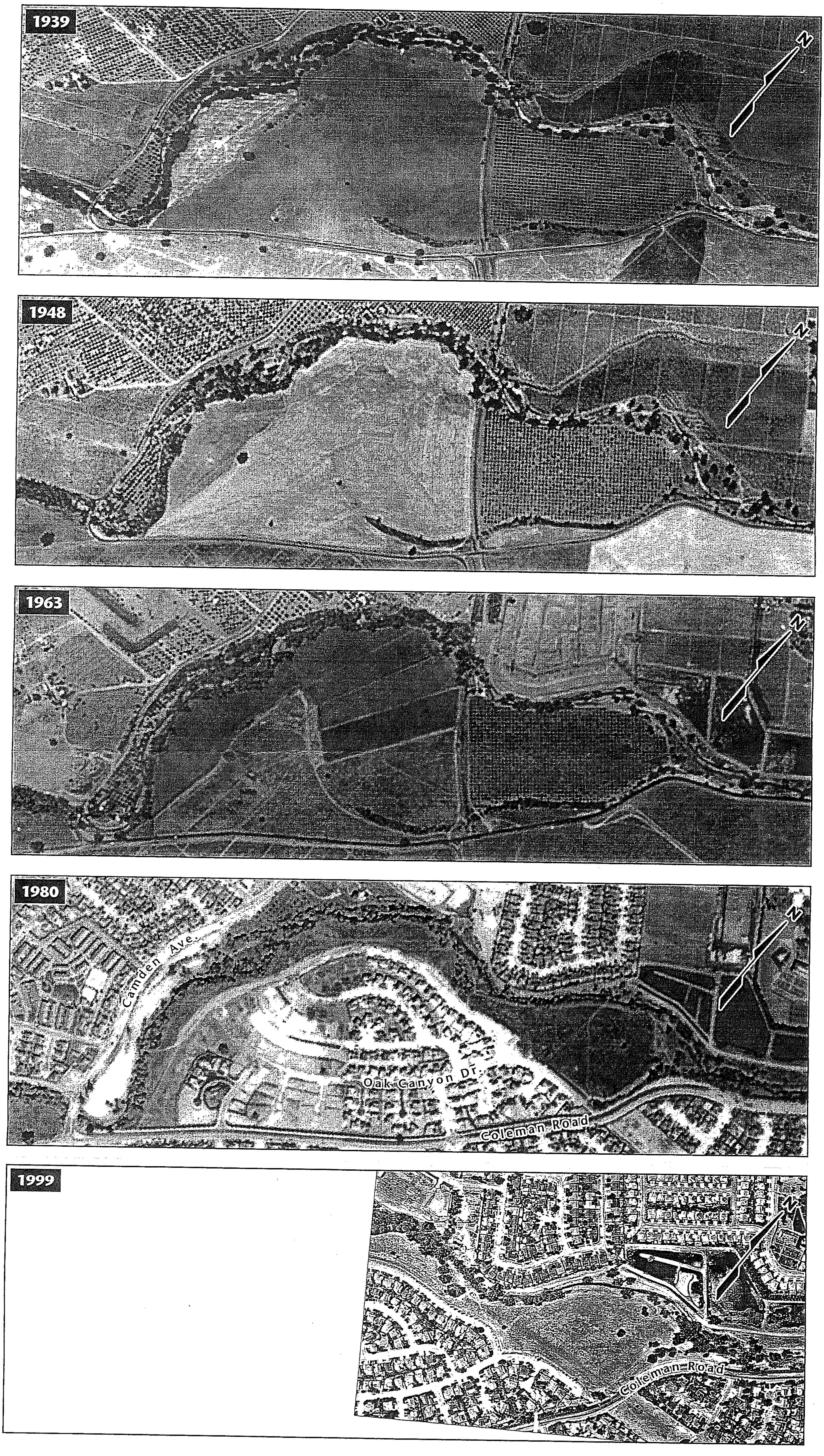


Figure 3-33
Historical Comparison of Guadalupe Creek
Reach 4 and Upstream to Camden Avenue

areas. This vegetation and natural recruitment is still constrained by the hydrology of the creek and the scouring flows of the incised channel.

There are some indications that invasive exotic species may have recently expanded, probably as a result of dispersal from yard plantings from recently established residential neighborhoods. In particular, periwinkle (*Vinca major*), fan palm (*Washingtonia filifera*), eucalyptus (*Eucalyptus sp.*), pyracantha (*Pyracantha angustifolia*), and river she oak (*Casuarina equisetifolia*) are species that readily disperse and can become widely established in wildland areas. Since residential development near the project area is very recent, these invasive species can be expected to increase in the future, if they are not controlled.

3.3.2 Existing Vegetation

The following text includes a discussion on plant community classification, major plant associations within the project area, vegetation conditions by geomorphic reach, and nonnative invasive plant species.

3.3.2.1 Plant Community Classification

The remnant sycamore islands remaining in the project area conform to the sycamore alluvial woodland of Holland (1986) and the California sycamore series in Sawyer and Keeler-Wolf (1995). Keeler-Wolf et al. (1997) described Central California sycamore alluvial woodland in detail. The subtype for the general area of the project area is the mid-coastal alluvial group. Mean tree cover for this type is 57%, but the cover ranges from open woodland to dense forest (10–99% cover). The sycamore alluvial woodland is typically formed on braided, depositional channels of intermittent streams, gullies, springs, seeps, stream and riverbanks, and terraces adjacent to floodplains subject to high-intensity flooding. The alluvial soils are generally cobbly, rocky, and coarse-textured. The upstream portion of the project area, Reach 4, has a predominance of western sycamore, but the creek has a single-channel configuration with relatively steep slopes and more of a riparian forest-type canopy than a woodland. Vegetation composition is similar to the sycamore alluvial woodland, except that coast live oak, arroyo willow, and Fremont cottonwood become more prevalent.

The CDFG Natural Heritage Data Base developed a terrestrial natural communities classification system to assist in the location and determination of significance and rarity of various vegetation types. These plant communities are listed as high priority for inventory, with the implication that these habitats are relatively scarce on the landscape. The Central California Sycamore Alluvial Woodland and Central California Sycamore-Cottonwood Forest are designated as sensitive plant communities. The tree canopy is dominated by widely spaced western sycamore and valley oak trees. Other tree species include arroyo willow, white alder, California bay, coast live oak, Fremont cottonwood, and black cottonwood (*Populus balsamifera*). Small trees include California buckeye, blue elderberry, red willow, and white alder. Shrubs include mule fat and snowberry (*Symphoricarpos* sp.).

3.3.2.2 Major Plant Associations within the Project Area

During the initial project area inventory, four types of vegetation were mapped: annual grassland, mesic grassland, shrub/vine scrub, and willow scrub. In addition, the canopy of large trees was mapped. An analysis of the mapped vegetation with an integration of geomorphic understanding of the project area suggests there are four patterns of plant association:

- vegetation adjacent to the low-flow channel;
- shrub-dominated vegetation along the banks;
- vegetation associated with the residual sycamore islands; and
- areas dominated by annual grasslands.

Vegetation Adjacent to the Low-Flow Channel. White alder, red willow, Fremont cottonwood, and mule fat are establishing along the wetted perimeter of the low-flow channel. Shrub and willow vegetation is almost always found in wide, unconfined channel cross sections, growing within approximately 6 vertical feet of the channel bed and on a gradual slope, typically about 1:10. Plants are successful at the water's edge where the water does not erode vegetation and where there is some base flow to avoid dessication of newly establishing seedlings. There is no evidence of revegetation constraints from soil texture, fertility, or the presence of phytotoxins.

Understory emergent vegetation includes narrow-leaved cattail (*Typha latifolia*), bur-reed *(Sparganium eurycarpum)*, water primrose (*Ludwigia peploides*), field mint (*Mentha arvensis*), poison hemlock (*Conium maculatum*), curly dock *(Rumex crispus)*, common horsetail (*Equisetum arvense*), soft rush *(Juncus effusus)*, nutsedge (*Cyperus eragrostis)*, mugwort (*Artemisia douglasiana*), and willow herb *(Epilobium* sp.).

Shrub–Dominated Vegetation along the Banks. Vegetation density is high in this area. Dominant saplings and shrubs along the first terrace include coyote bush (*Baccharis pilularis*), mule fat, Himalayan blackberry, coast live oak, arroyo willow, elderberry, and California sage (*Artemisia californica*). Dominant herbaceous plants include smilo grass (*Piptantherum milaceum*), periwinkle, mugwort, fennel, California poppy (*Eschschulzia californica*), creeping wild-rye (*Leymus triticoides*), wild cucumber (*Marah fabaceus*), cocklebur (*Zanthium strumarium*), Bermuda buttercup (*Oxalis pes-caprae*), curly dock, and California nettle (*Urtica californica*).

Residual Sycamore Habitat Island. Habitat islands dominated by large sycamore trees were protected during past modifications to the creekway (including mining, flood control, and percolation pond construction) and are now elevated above the current floodplain. The large, multitrunked western sycamores are in association with valley oak, mule fat, coffeeberry (*Rhamnus californica*), coast live oak, interior live oak, snowberry (*Symphoricarpos albus*), blue elderberry, olive (*Olea europa*), wax-myrtle (*Myrica californica*), buckeye, Oregon ash *(Fraxinus latifolia*), box elder (*Acer negundo*), California bay, fan palm, California rose (*Rosa californica*), California blackberry (*Rubus ursinus*), Himalayan blackberry, hedge-nettle (*Stachys chamissonis*), periwinkle, cape ivy (*Senecio mikanioides*), poison oak, and wild cucumber (*Marah fabaceus*).

Annual Grassland-Dominated High Terrace. High terraces are dominated by nonnative annual grasses and forbs. These species include wild oat grass (*Avena sativa*), Italian ryegrass (*Lolium multiflorum*), Mediterranean barley (*Hordeum marinum spp. leporinum*), filaree (*Erodium cicutarium*), annual bluegrass (*Poa annua*), smilo grass, ripgut brome, soft chess (*Bromus mollis*), wild radish (*Raphanus sativus*), black mustard (*Brassica nigra*), yellow star thistle, Himalayan blackberry, wild teasel (*Dipsacus fullonum*), fennel, scarlet pimpernel (*Anagallis arvensis*), and horehound (*Marrubium vulgare*). The species composition and plant vigor depends on soil type and the moisture holding capacity of the soil. In general, course-textured soils on the high terraces contain xeric species, such as annual grasses, yellow star thistle, and fennel.

3.3.2.3 Vegetation Occurring along Geomorphic Reaches

The 8,700-foot project area has been divided into four distinct geomorphic reaches. Each reach has a distinctive vegetation assemblage associated with flow characteristics, soil texture and moisture holding capacity, channel incision, and depth to groundwater.

3.3.2.4 Reach 1

Reach 1 is characterized by large, alternating gravel bars that create a broad channel bed, resulting in wide, shallow flows at relatively low rates. Vegetation along the water's edge is dominated by red willow, cattails, water primrose, and smilo grass. Gravel bars in this reach are essentially unvegetated. Most of the area is dominated by nonnative annual grasses and forbs. Woody vegetation consists primarily of isolated western sycamore, oak trees, coyote bush, and Himalayan blackberry.

3.3.2.5 Reach 2

Reach 2 spans sections of the project area extending to either side of Meridian Bridge. In 1994, the construction of summer instream percolation dams was halted. In this area, the upstream end of the old instream percolation pond resulted in deposition of fine sediments. Dense rhizomatous stands of sandbar willow occur in this reach. Hypothetically, the fine-textured sediments and prolonged water availability provided an appropriate substrate for successful sandbar willow colonization. Overstory species are sporadic along this reach, with increasing amounts of annual grasses and ruderals characteristic of the high terrace.

3.3.2.6 Reach 3

Reach 3 is characterized by a very wide floodplain bench on the north bank that extends continuously for approximately 1,500 feet. Six large sycamore habitat islands were preserved in this reach, leaving micro-habitats under the canopy with plants characteristic of this vegetation type. Overstory western sycamore are sporadic but increasing in relative cover along this reach.

Significant amounts of annual grasses and ruderals characteristic of the high terrace are also prevalent in Reach 3. Soils tend to be very cemented along the stream banks, precluding most plant species from growing in these areas. Red willow and alder colonize the streamside vegetation zone. Most of this reach was flooded during the summer months behind the instream spreader dams. This flooding most likely killed any seedlings that would have germinated in the spring.

3.3.2.7 Reach 4

Reach 4 exhibits an entrenched channel cross section that is narrow and confined compared to other geomorphic reaches. Vegetation includes the presence of more trees and woody vegetation than in other reaches. Species characteristic of the Central California Sycamore-Cottonwood Forest, including sycamore, Fremont cottonwood, coast live oak, elderberry, mule fat, poison oak, mugwort, horehound, and wild cucumber, are dominant in this reach. Alder, Fremont cottonwood, and red willow are colonizing the wetted perimeter of the low-flow channel. There is high structural diversity in the vegetation and more shade for the creek in this reach. The Phase 1 riparian plantings are located in this reach.

3.3.2.8 Nonnative Invasive Plant Species

Weed species occurring onsite include yellow star thistle, periwinkle, cocklebur (*Xanthium strumarium*), Himalayan blackberry, wild teasel, Peruvian pepper tree (*Schinus molle*), blackwood acacia (*Acacia melanoxylon*), Eucalyptus, pyracantha, river she oak (*Casuarina equisetifolia*), cape ivy, scotch broom (*Cytisus scoparius*), fennel, wild oat, Farmer's foxtail, filaree, and black mustard (*Brassica nigra*).

3.3.3 Natural Recruitment of Native Plants

3.3.3.1 Limits on Natural Recruitment and Propagule Availability

Natural recruitment is limited in the project area. Sycamore cottonwood riparian forest occurs upstream from the project area, providing a source of propagules for natural recruitment of riparian species. Although this source exists, little natural recruitment is present. Seeds are dispersed through wind, water, and animal vectors, such as birds and mammals. Plants such as California buckeye, sycamore, and oaks are often not dispersed far from the parent plant without an animal vector.

Seeds have difficulty germinating and growing to maturity due to the following:

- scouring and erosion that occurs during peak flows,

- seed dispersal occurring during summer and fall when stream flows are low due to seasonal drought in the project area,

- dessication of seedlings due to sharply declining hydrograph,

- a constricted wetted perimeter during summer low flows,

- groundwater recharging the regional aquifer with average water table depths of 8 feet,

- coarse-textured or cemented soils with low moisture holding capacity, and

- competition with annual grasses and other exotic weeds.

Unfortunately, there are also sources of weeds upstream and adjacent to the project area, including residential areas and disturbed ground, resulting in a high potential for infestation of plants such as scotch broom, Himalayan blackberry, cape ivy, periwinkle, star thistle, and others.

3.3.3.2 Natural Recruitment Plan Guilds

Growth and reproduction of dominant woody plants in the project area are illustrated in Table 3-11. These data were used to develop four natural recruitment guilds that correspond to the four intergrading plant communities designed for the project area.

Guild 1. Guild 1, the riparian forest, includes Fremont cottonwood, arroyo willow, red willow, and alder. These species require lower surface elevations adjacent to the low-flow channel for germination of seeds. Seed dispersal is synchronous with peak hydrologic discharges, resulting in an increased potential for seedling establishment. These species also reproduce vegetatively, grow rapidly, provide abundant shade, and have the potential to contribute large woody debris to the stream over time.

Guild 2. The following species are well adapted to lower first terrace surface elevations for natural regeneration: mule fat, box elder, Oregon ash, western sycamore, elderberry, snowberry, and California blackberry. The seed dispersal period of these species occurs in late fall, with germination occurring with the first winter rains. These species are fairly drought tolerant and tolerate moderate shade and leaf litter development on the soil surface.

Guild 3. The following plants are characteristic of the more xeric second terraces of the sycamore alluvial woodland and tolerate drier conditions once established. These species include buckeye, coyote brush, coast live oak, interior live oak, valley oak, elderberry, California sage, California rose, and California bay. With irrigation, these species are likely to have good regeneration success.

Guild 4. Micro-habitats associated with large woody debris and sandbars within the waterway provide a suitable substrate for species that require moist soil conditions, tolerate inundation, and rely on vegetative reproduction for at least some of their life history. These species include sandbar willow, red willow, alder, Santa Barbara sedge (*Carex barbarae)*, wooly sedge (*C. lanuginosa*), mint, rush (*Juncus effusus*), bur-reed, cattail, and nut sedge (*Cyperus eragrostis*).

3.3.4 Guadalupe Creek Phase 1 Planting Survey

3.3.4.1 First-Year Survey Results of Phase 1 Planting

Of the 303 individual plants that were planted and survived the first year, seven plant species seem well-adapted to project area conditions (see Table 3-12). These species are red willow, mule fat, box elder, western sycamore, Fremont cottonwood, valley oak, and blue elderberry. Planted species that seem to have very high mortality include white alder, California buckeye, California rose, sandbar willow, and arroyo willow. Natural recruitment occurring in this area included mule fat, red willow, western sycamore, blue elderberry, and one white alder. Box elder, white alder, mule fat, red willow, and arroyo willow produced the most height during the first year.

Table 3-12. Phase 1 Revegetation Summary for Guadalupe Creek

Scientific Name	Common Name	Number Survived	Number of Volunteers	Average Height (feet)
Acer negundo	box elder	31	0	4.8
Alnus rhombifolia	white alder	4	1	5.1
Aesculus californica	buckeye	13	0	6.4
Baccharis salicifolia	mule fat	52	31	2.2
Platanus racemosa	sycamore	30	8	3.9
Populus fremontii	cottonwood	28	0	2
Quercus lobata	valley oak	39	0	3
Rosa californica	rose	12	0	2
Salix exigua	sandbar willow	5	0	4.7
Salix laevigata	red willow	55	17	7.8
Salix lasiolepis	arroyo willow	2	0	2.9
Sambucus mexicana	elderberry	32	2	
Total		303	59	

3.3.5 Project Area Constraints - Trends Without Project

3.3.5.1 Project Area Conditions

Based on historic evidence, project area conditions are likely to remain unchanged without altering peak flow velocity, lowering surface elevations closer to the low-flow channel, irrigating during plant establishment, and controlling weeds. Little change in project area vegetation characteristics has been observed over the past 60 years. Channel planform from 1948 to 1978 mapping is nearly identical, reflecting the general stability in the river channel for the period.

Table 3-11. Dominant Woody Plant Growth and Reproduction

Common Name	Scientific Name	Mature Height (feet)	Natural Recruit Guild	Flowering Dates	Seed Dispersal	Seed-Bearing Age (years)	Seed-Bearing Interval	Seed Dispersal	Germination Sites	Planting Surface	Available Soil Moisture	Shade Tolerance
Box elder	*Acer negundo*	76	2	March– May	Sept.– March	2–3	Annually	Wind, water		1st and 2nd Terrace	Mesic	Moderate
California buckeye	*Aesculus californica*	42	3	April– Sept.	Nov.– Dec. (after rains)	5	1–2 years	Gravity	Fine textured soil, moist, shade	2nd Terrace	Mesic	Shade
White alder	*Alnus rhombifolia*	79	1	March	Fall	2-3	Annually	Water, wind	Bare and Very Moist	Waters edge, moist	Aquic	Light
California sage	*Artemisia douglasiana*	1-3	3	Sept.– Oct.	Oct.– Dec.	2–3	Annually	Wind		2nd Terrace	Xeric	Light
Mule fat	*Baccharis salicifolia*	13	2	March– Oct.	March– Oct.	1–2	Annually	Wind	Coarse-textured soil	1st and 2nd Terrace	Mesic	Moderate
Oregon ash	*Fraxinus latifolia*	60-80	2	March– May	Fall	2–3	3–4 years	Wind or water		1st and 2nd Terrace	Mesic	Moderate
Western sycamore	*Platanus racemosa*	80	2	March– April	Sept.– Dec.	5–10	1–2 years	Gravity, water	Bare floodplain exposure to light	Waters edge, 1st Terrace	Phreatophytic	Moderate
Fremont cottonwood	*Populus fremontii*	102	1	Feb.– March	Feb.– March	5–10	Annually	Wind	Moist + bare substrate	Waters edge, 1st Terrace	Phreatophytic	Light
Black cottonwood	*Populus balsamifera*	102	1	Feb.– April	Feb.– April	5–10	Annually	Wind	Moist + bare substrate	Waters edge, 1st Terrace	Phreatophytic	Light
Coast live oak	*Quercus agrifolia*	75	3	March– April	Late Sept., Oct.	15	Annually	Gravity, Animals	Coarse sand, moist	2nd Terrace	Xeric	Moderate
Valley Oak	*Quercus lobata*	102	3	March– April	Late Sept., Oct.	10	2–3 years	Gravity, Animals	Coarse sand, moist, shaded	1st and 2nd Terrace	Phreatophytic	Moderate
Interior live oak	*Quercus wislizenii*	62	3	March– April	Late Sept., Oct.	5–10	5–7 years	Gravity, Animals	Coarse sand, moist	2nd Terrace	Xeric	Moderate
Willow	*Salix spp.*	560	1	Feb.–May	May– June	1–2	Annually	Wind	Moist sand, alluvium	Waters edge, 1st Terrace	Aquic, Mesic	Light
Blue elderberry	*Sambucus mexicana*	19	2	May– Sept.	June– Oct.	2–3	Annually	Gravity, Animals	Shade + soil moisture	1st and 2nd Terrace	Mesic	Moderate
Snowberry	*Symphoricarpus albus*	1-2	2	June– Sept.	August–Oct.	2–3	Annually	Gravity, Animals	Shade + soil moisture	2nd Terrace	Mesic	Shade
California bay	*Umbellularia californica*	78	3	April– May	May– June	30–40	Annually	Gravity	Shade + soil moisture	2nd Terrace	Xeric	Shade

However, due to recent urbanization, invasive exotic species may be expected to increase in abundance in the future.

3.3.5.2 Plant Recruitment

Plant recruitment is limited by project area geomorphology and hydrology. Peak flows erode both sandbar sediments and establishing vegetation.

3.3.5.3 Water Availability

Seedlings dessicate rapidly as water becomes unavailable by April or May. Available water leaves soil surfaces outside the wetted perimeter of the low-flow channel fairly rapidly. The District maintains flows of 3–4 cfs downstream from Masson Dam. Approximately 2.5–3.5 cfs of this flow infiltrates into the subsurface between Masson Dam and Almaden Expressway. The District attempts to maintain a minimum of 0.5 cfs in the creek at Almaden Expressway. During extended dry periods, the storage capacity of Guadalupe Reservoir is not sufficient to maintain flow in the creek for the entire year.

3.3.5.4 Soil Condition

The substrate for seed germination and seedling establishment is very poor for the majority of the project area. Soils are coarse textured with very low moisture holding capacity or are cemented.

3.3.5.5 Depth to Groundwater

It is difficult for roots to penetrate to the permanent water table. Most of the project area has a losing water table, with groundwater averaging 8 feet below the soil surface.

3.3.5.6 Wetted Perimeter along Low-Flow Channel

Natural vegetation persists and will continue to persist in a narrow band along the creek where adequate water is available. Willow, alder, and mule fat establish along the wetted perimeter of the low-flow channel, along with wetland vegetation such as bur-reed, mint, horsetail, mugwort, and willow-herb. Shallow river channels and warm water temperatures during summer low flows result in dense layers of creeping macrophytes, particularly smartweeds (*Polygonum* spp.), water primrose, and filamentous algae.

3.3.5.7 Sediment Accretion

Currently, there is limited deposition of fine-grained sediments in the channel.

3.3.5.8 Loss of Large Sycamores

Large western sycamores may fall into the creek as their roots are eroded and the toe of the bank becomes more undercut as the channel continues to incise. In reaches where the channel continues to incise, the distance between the channel and the floodplain would be greater, so plants continue to be higher and drier.

3.3.5.9 Invasive Weeds

Many weedy plants that are well-adapted to the conditions may readily colonize the project area. Project area conditions are suitable for tamarisk, giant cane, star thistle, annual grasses, Himalayan blackberry, and escaped ornamental plants. These and other weedy exotic species are likely to continue to expand in the project area if no future action occurs.

3.4 FISHERIES

This portion of the document describes existing and desired conditions for aquatic habitat for the project area. An emphasis has been placed on species listed under the Endangered Species Act (ESA) and candidate species, including steelhead (*Oncorhynchus mykiss*) and chinook salmon (*Oncorhynchus tshawytcha*); and the habitat of these species.

3.4.1 Fish Occurrence

3.4.1.1 Steelhead

Steelhead found in the Guadalupe River basin are considered part of the Central California Coast evolutionarily significant unit (ESU). Only winter steelhead occur within the Central California Coast ESU (61 FR 41541-41561, August 9, 1996). Generally, adult steelhead within this ESU may start to enter rivers from October (in larger basins) through late November (in smaller basins) and may be present in the river through June. Adult spawning begins in November in larger basins and December in smaller basins and can continue though April, with a peak in February and March (61 FR 41541-41561, August 9, 1996). Because little additional life-history information exists for steelhead in this ESU, the following life-history information is summarized from Shapovalov and Taft (1954), who conducted one of the most comprehensive investigations of steelhead life history in the Central California Coast ESU as part of studies conducted on Waddell Creek in Santa Cruz County.

Adult steelhead leave the ocean to migrate up coastal streams and inland rivers with high flows from early November through early May, though the majority probably enter fresh water from late December though late April (Table 3-13). The timing and rate of migration depend on several factors, including stream discharge and water temperatures. Depending on the sexual maturity of the fish, spawning probably peaks from January through March. Adult steelhead spawn in shallow nests constructed in relatively clean, loose gravels, typically at the end of pools and at the head of riffles that have appropriate water depths and velocities. Unlike all Pacific salmon, which die after spawning, adult steelhead are capable of returning to the ocean after spawning, typically by June of that same year (Shapovalov and Taft 1954).

Steelhead eggs incubate within the gravel and hatch after approximately 19–80 days at water temperatures ranging from 60 to 40 °F. The average incubation period is approximately 4–6 weeks. After hatching, the young fish (alevins) remain in the gravel for an additional 2–6 weeks before emerging and taking up residence in the shallow margins of the stream. The juvenile fish feed primarily on aquatic and terrestrial insects for periods ranging from less than 1 year to 4 years. Most juvenile steelhead spend 1–3 years in fresh water before migrating to the ocean as smolts (Shapovalov and Taft 1954).

Table 3-13. Temperature Requirements (°F) for Life Stages of Chinook Salmon and Steelhead during the Months Present in the Guadalupe River

Life Stage	Chinook Salmon	Steelhead
Pre-spawning adults	August–December	November–April
Optimal	46.4–53.6	44.0–57.0
Suboptimal	53.6–75.2	57.0–65.0
Unacceptable	>75.2	>65.0
Egg incubation	October–March	January–May
Optimal	41.0–57.2	44.6–53.6
Suboptimal	57.2–60.8	53.6–60.8
Lethal	>60.8	>60.8
Juvenile rearing	January–June	All Months
Optimal	53.6–64.4	53.6–64.4
Suboptimal	64.4–75.2	64.4–77.0
Lethal	>75.2	>77.0
Juvenile emigration	February-June	January–July
Optimal	53.6–64.4	44.6–59.9
Suboptimal	64.4–75.2	59.9–66.2
Unacceptable	>75.2	>66.2

Sources: Raleigh et al. 1984, 1986; Rich 1987; Shapovalov and Taft 1954; Moyle 1976.

Steelhead smolt, those juveniles developed sufficiently to live in salt water, typically migrate to the ocean as flow declines and water temperature increases in April–June. Before their downstream migration, juveniles undergo physiological changes (smoltification) to prepare them for life in the saltwater of the ocean. Steelhead live in the ocean for 1–3 years before maturing and returning to fresh water to spawn. Because juvenile steelhead rear year-round in fresh water, adequate flows and water temperatures and an abundant food source are necessary throughout the year to sustain steelhead populations. Conditions adequate to sustain steelhead populations are especially important during summer, when declining flows could reduce habitat availability, water temperatures could exceed the species' tolerance levels, and rearing juveniles experience increased competition for living space and food. It has not been determined whether juvenile steelhead rear though the summer in the Guadalupe River, where water temperatures in summer often exceed 70 °F.

Historically, steelhead potentially existed throughout the Guadalupe River system (Skinner 1962); however, after completion of Almaden and Guadalupe Reservoirs in the mid-1930s and Lexington Reservoir in 1952, steelhead migration was restricted to tributary streams downstream from the dams. Prior to the fall of 1999, steelhead entering the Guadalupe River system were prevented from migrating to upstream spawning and rearing areas on the tributary streams by the District's Alamitos drop structure, located downstream from Almaden Lake. The Alamitos drop structure was originally constructed in the 1930s and reconstructed in 1977. Consequently, any steelhead entering the Guadalupe River system were forced to spawn in the Guadalupe River and in Los Gatos and Ross Creeks. The Alamitos drop structure blocked salmonid fish passage until the construction and opening of the fish passage ladder in 1999.

Rainbow trout in Guadalupe Creek may be part of the Central California Coast ESU for steelhead. The presence of rainbow trout on Guadalupe Creek has been well documented. In the 1950s, CDFG documented the presence of rainbow trout in Guadalupe Creek from Camden Road upstream to Guadalupe Dam, in Pheasant Creek, and in Rincon Creek (upstream from Guadalupe Reservoir) (Leidy 1984). In December 1986, The Habitat Restoration Group collected rainbow trout at three sites along Guadalupe Creek, from the District's stream gage station on Hicks Road to approximately 1 mile downstream from Guadalupe Reservoir. Rainbow trout were collected from lower Guadalupe Creek upstream and downstream from Masson Dam during sampling in the early 1990s (The Habitat Restoration Group 1994). In 1997, rainbow trout were collected during May at SCVWD's stream gage station on Hicks Road and immediately downstream from Masson Dam in July. In general, rainbow trout in Guadalupe Creek appear to be most abundant from Guadalupe Reservoir downstream to Camden Avenue (U.S. Army Corps of Engineers 2000).

3.4.1.2 Chinook Salmon

Although there is no historical account of chinook salmon migrating and spawning in the Guadalupe River, fall-run chinook salmon have occurred in the Guadalupe River at least during the last decade. The current chinook salmon population may be strays from wild or hatchery populations from the Sacramento-San Joaquin River system (The Habitat Restoration Group 1994, Santa Clara Valley Water District 1997b). The results of a genetic analysis of these fish conducted to determine their origin have been inconclusive, though some adults were clearly from the Sacramento River watershed (Nielsen 1995). The Central Valley fall/late-fall ESU includes fall- and late-fall-run chinook salmon that spawn in the Sacramento and San Joaquin River drainages of northern California's Central Valley. The overall population abundance for chinook salmon in this ESU is relatively high; however, the abundance of naturally produced fish is declining. Natural production is especially low in the San Joaquin River drainage (63 FR 11481; March 9, 1998).

Adult fall-run chinook salmon migrate into rivers from July though December and spawn from early October through late December (Table 3-13). Spawning peaks in October–November, though the timing of the runs varies from year to year. Eggs incubate from October through March and juveniles rear and migrate from January through June. The majority of young fall-run chinook salmon migrate to the ocean during the first few months following emergence.

All chinook salmon require cold, fresh water streams with suitable gravel for reproduction. Females deposit their eggs in redds that they excavate in the gravel bottom in areas of relatively swift water. Chinook salmon currently migrate up the Guadalupe River and, to a lesser extent, Lost Gatos Creek to spawn. Data on spawning adult abundance are limited. Spawning occurs from above the influence of tidewater through the project area of Guadalupe Creek, though the majority of chinook salmon appear to spawn in and around the downtown San Jose area. Eggs hatch in approximately 6–12 weeks, and newly emerged larvae remain in the gravel for another 2–4 weeks until the yolk is absorbed (Moyle 1976, Beauchamp et al. 1983, Allen and Hassler 1986). For maximum survival of incubating eggs and larvae, water temperatures must be between 41 and 57 °F. After emerging, chinook salmon fry tend to seek shallow, nearshore habitat with slow water velocities and move to progressively deeper, faster water as they grow. Juveniles rear in fresh water for up to 5 months before migrating to sea. Chinook salmon spend 2–4 years maturing in the ocean before returning to their natal streams to spawn. All adult salmon die after spawning (Moyle 1976, Beauchamp et al. 1983, Allen and Hassler 1986, Raleigh et al. 1986).

3.4.1.3 Other Species

Other species known to occur within the project area include both native and introduced species, such as the native Pacific lamprey (*Lampreta tridentata*), Sacramento sucker (*Catostomus occidentalis*), California roach (*Hesperoleucas symmetricus*), the introduced goldfish (*Carrassius auratus*), and green sunfish (*Lepomis cyanellus*). Introduced largemouth bass (*Micropterus salmoides*) are also suspected to occur within the project area because they are found upstream in the Guadalupe reservoir as well as downstream in the Guadalupe River. Crappie (*Pomoxis nigromaculatus*), bluegill (*Lepomis macrochirus*), green sunfish, and largemouth bass are also suspected to be present in the Los Capitancillos percolation ponds adjacent to the project area.

Several nonnative species, including largemouth bass and sunfishes, may compete with steelhead and chinook salmon for food or suitable habitat and prey on salmonid larvae and juveniles. Vulnerability of juvenile salmonids to predation increases at human-made structures, such as dams, weirs, and impoundments, where fish are concentrated, stressed, or delayed in their downstream migration. Vulnerability of juvenile salmonids to predation can also increase if water temperatures approach tolerable levels or if channel structure creates conditions that increase the abundance of predatory fish. Some of the deep pools found within the Guadalupe Creek project area are suspected to be too deep to flush out the deeper bodied introduced species during high winter flows.

3.4.2 Habitat Structure

3.4.2.1 Overhead Cover

Riparian vegetation, including SRA cover vegetation, provides fish with cover from predators; provides streambank stability; increases habitat complexity; provides insects, a food source for juvenile salmonids, with attachment sites; and provides shade, which is important in maintaining water temperatures within ranges suitable for all life stages of fish.

The amount of stream shading, based on the stream covered by overwater vegetation, varies considerably within the project area but is generally very low. Guadalupe Creek has approximately 12% of stream area shaded by canopy. For juvenile steelhead, at least 50% of the stream areas should be shaded (Raleigh et al. 1984). The lack of canopy cover has contributed to stream temperatures through the reach that approach unhealthy levels for steelhead during the summer.

3.4.2.2 Instream Cover

Instream cover is an important component of fish habitat. Steelhead abundance is directly correlated with the amount of instream cover (Raleigh 1984). Instream cover includes undercut banks with an undercut width greater than 10 centimeters (cm); roots, logs and debris piles greater than 1000 cm^2 in surface area; and boulders and rocks greater than 20 cm in diameter (Jones & Stokes 1997, Fris and DeHaven 1983). Wood and boulders add complexity by defining the thalweg and by scouring pools and slow water eddy habitat. Cover for adult trout consists of areas of obscured stream bottom in water that is at least 15 cm deep with a velocity of at least 15 cm/second. In larger streams, the abundance of trout at least 15 cm in length increased with water depth; most trout were at depths of at least 15 cm. Cover area of at least 25% of the total stream area provides adequate cover for adult trout; cover area of greater than 15% is adequate for juveniles (Raleigh 1984).

IWM is an important part of ecological function in headwater streams. Ecologist define IWM as any piece of wood at least 10 cm in diameter at the small end and at least 1.5 meters in length. IWM includes whole trees, broken tops, branches and root wads. Larger pieces are more likely to affect stream channel morphology, and entire trees with root wads are more likely to make long-term contributions to instream habitat and channel morphology. IWM provides primary and secondary productivity, provides integral fish habitat, and controls sediment yield in watersheds. IWM provides grazing surfaces, food source and sediment and seston traps for invertebrates. During high flows sediments are trapped and stored, providing additional spawning gravels for anadromous fish. (Robison and Beschta 1990; Bilby and Ward 1991; Fausche and Northcote 1992; Crispin et al. 1993; Beechie and Sibley 1997.)

Large, fallen trees affect live vegetation along watercourses. Trees carried by flood waters can severely batter live plants on a floodplain but normally only in a narrow belt along the immediate channel. On the other hand, large, stabilized pieces of wood protect riparian sites where riparian plants can become established. Live vegetation eventually stabilizes a stream channel. Features such as gravel bars also become stabilized and enriched with fine sediments and organic materials as plant root systems develop and the stems resist the flow of water and reduce water velocity. (Sedell et al 1988) Willows and alders have been slow to establish in the project area, which may be due to channelization, downcutting, and ground water depth. Flows are too high and fast during the high flow period, scouring young willow and alder seedlings away.

Habitat complexity in the project area is poor because existing woody material in the stream is too small to remain in place to actively enhance habitat and geomorphology. Live sycamore root masses that have been exposed by flows are an important part of the woody material in Guadalupe Creek. These root masses have helped scour pools and are currently good habitat for juvenile and adult salmonids. Undercut banks also occur throughout the project area. Approximately 110 feet of streambank is undercut more than 10 cm. Undercut banks found on Guadalupe Creek are generally associated with the live sycamore root masses that have scoured pools.

3.4.2.3 Pool Habitat

Pools differ in the amount and quality of escape cover, winter cover, and resting areas that they provide. Relatively large and deep pools are needed to provide a low velocity resting area for adult fish. More than 20% of the pools should have the pool bottom obscured by surface turbulence or the presence of structures such as logs, debris piles, boulders, or overhanging banks and vegetation. The dominant pool forming elements are IWM, boulders, and bedrock protrusions (Dolluff 1994). Table 3-14 describes the different types of pools that can be found in streams, how they are formed, and where they are found in the channel. Pools provide cover and resting areas for adult fish. More fish can hold in larger pools. Pools are also needed as juvenile habitat, providing needed cover, rearing, and resting areas. Optimal percentage of pools range from 35 to 65% of total stream area during the late growing, low-water season for chinook salmon and steelhead (Raleigh et al. 1984, 1986).

Approximately 25% of the total stream area within the project area consists of pools. Pools found in the project area are considered fair habitat. Lateral scour pools dominate the type of pools found in Guadalupe Creek. Some of the larger pools are eddy pools caused by the large root masses of mature sycamores. Several of the deeper pools within the project area are straight scour pools.

Table 3-14. Pool Types and Design Considerations

Pool Type	Channel Location	Process Creating the Pool	Design Consideration	Habitat Notes
Lateral scour pool	Outside curve	Created by flows around curves; scour confined to 60% or less of wetted width	Create with instream structures	Provides feeding and resting stations for adults and juveniles
Straight scour pool	Occurs at gradient break or channel constriction	Created by mid-channel scour; 60% or more of wetted width	Create with IWM complex	Provides feeding and resting stations for adults and juveniles
Backwater eddy pool	Occurs along the stream edge	Formed downstream from large obstructions, such as boulders and logs	Create pool greater than 30 centimeters deep with IWM or boulders	Provides feeding and resting stations for adults and juveniles
Pocket pool	Found in riffles and runs	Formed by medium- to large-size boulder clusters midstream	Create with boulders within the wetted width	Provides feeding and resting stations for adults and juveniles
Alcove pool	Remnant channel or side channel	Formed in blocked or dried remnant outflow channel; maintained by subsurface flow and eddy current	Create at outflow of created flood overflow channels or created side channels	Provides excellent juvenile salmon rearing habitat
Plunge pool	Found across all or part of the channel	Formed by flow over an obstruction such as logs	Should be 1.25 times deeper than jump height where obstruction may block fish passage	Could be juvenile barrier if greater than 0.8 foot in height

3.4.2.4 Riffle/Run Habitat

Riffle habitats are shallow, fast-water areas with turbulent surfaces and runs are fast water areas with smooth surfaces. Riffles and runs are important spawning and food producing areas for adult and juvenile steelhead. The velocity for best food production in riffles and runs is between 1 and 3 feet per second (fps) and the depths between 0.4 and 1 foot. These velocities and depths and a gravel bed size of 1.28 inches create the best conditions for high productivity. (U.S. Army Corps of Engineers 1990). Approximately 5–10 % of the riffle area should be composed predominately of gravels 5–10 cm in diameter that contain less than 15% fine material measuring less than 2 cm in diameter.

The percent of stream area composed of riffles and runs is 60%, and 15%, respectively, in the Guadalupe Creek project area from Almaden Expressway to Masson Dam. Many of the riffles are too shallow reflective to the needs of steelhead and their food organisms.

Steelhead and chinook salmon require water depths of 0.6 and 0.8 foot, respectively, for upstream passage of adults (Thompson 1972). Flows within the project area during summer are approximately 0.5 cfs at Almaden Expressway. Adult migration may be blocked through several reaches by shallow depth until flows reach between 5 and 7 cfs. During the spawning period of October–April, only 25% of the days had flows high enough to allow fish migration. Analysis of flows and channel morphology indicates that passage conditions and accessability of spawning habitat in Guadalupe Creek will generally be better for adult steelhead rather than for chinook salmon. The majority of adult steelhead are expected to be present in the Guadalupe River from December through April, whereas adult chinook salmon may be present primarily from October through December. (Jones & Stokes 1998.)

3.4.2.5 Spawning Gravel

Substrate size and quality influence salmonid spawning success. For spawning, chinook salmon require substrate from 0.5–10 inches dominated by 1- to 3-inch gravel. Steelhead use gravels from 0.5 to 6 inches dominated by 1- to 3-inch gravel (Raleigh et al. 1984, 1986). Adult chinook salmon and steelhead require relatively clean gravels in which to lay their eggs, generally with less than 15% fines (< 3 mm). Gravels containing a higher proportion of fines (i.e., sand- and silt-sized particles) can affect spawning success by reducing the flow of water and oxygen to the eggs in the gravel, thereby reducing hatching success. Furthermore, fine sediments also can reduce or prevent young salmonids from emerging from gravels after they have hatched.

Substrate is also critical to the production of aquatic insects and survival of juvenile fish. Optimal substrate size and area is based on substrates containing the greatest number of aquatic insects and small juvenile steelhead (Raleigh et al. 1984, 1986). Substrate used as winter cover by rainbow fry and small juveniles ranges from 10–40 cm in diameter. An area of substrate greater than 10% of the total habitat probably provides adequate cover for rainbow fry and small juveniles. The use of smaller substrates as winter cover will increase mortality of young fish due to the shifting of substrates (Dolluff 1994).

Gravel for spawning and rearing habitats within the project area is considered poor because substrates are generally embedded and shallow; however, a few pockets of good gravels do occur within the project area. Gravel quality and quantity will be measured prior to restoration activities (U.S. Army Corps of Engineers 2000).

3.4.2.6 Water Temperature

Water temperature is affected by weather, reservoir operations, flow, tributary inflow, groundwater, and physical habitat including shading by riparian vegetation. Water temperature is especially important for chinook salmon and steelhead, which have relatively narrow temperature requirements for carrying out their life history. Table 3-13 presents thermal requirements for life stages of chinook salmon and steelhead based on information from the published literature (Raleigh et al. 1984, 1986). Each life stage of chinook salmon and steelhead has different physiological responses to water temperature conditions. In general, as optimal water temperatures are exceeded, chinook salmon and steelhead can experience increased stress, resulting in greater susceptibility to disease, reduced assimilation efficiency, and increased mortality.

Steelhead rear in streams for up to three years; therefore, summer rearing temperature is a critical time. Optimal rearing temperatures for steelhead range from 54–64 °F, with an upper lethal temperature of 77 °F.

Stream temperature is a limiting factor within the project area. The lack of canopy cover has resulted in stream temperatures that are suboptimal, especially during summer months. The maximum stream temperature recorded at Almaden Expressway was 87 °F, recorded in July. The maximum water temperature at Masson Dam was 71 °F, recorded in October; 69 °F was the recorded maximum high in July. In Guadalupe Creek, critical limiting water temperature for juvenile steelhead occurs during summer rearing. Summer temperatures in Guadalupe Creek range from 56 to 87 °F at Almaden Expressway and 55 to 71 °F at Masson Dam (water temperature data from SCVWD for 1996 and 1997). Water temperature will continue to be monitored and simulated prior to and after restoration, documenting improvements to water temperature conditions for steelhead (U.S. Army Corps of Engineers 2000).

3.5 LAND USE, INFRASTRUCTURE, AND PUBLIC HEALTH AND SAFETY

3.5.1 Land Use

A variety of land uses occur near or adjacent to the Guadalupe Creek project area. The creek is currently designated as open space. The majority of the project area is owned by the District. The creek is surrounded by residential land uses. The majority of the residential areas are separated from the creek by roads, undeveloped parcels, and the Los Capitancillos percolation ponds. The undeveloped properties are described in more detail below. The Le Mirador Senior Apartments border the corner of Coleman Road and Almaden Expressway. The north side of the creek is developed with primarily medium-density residential housing, some very high-density residential apartment complexes, and Pioneer High School. The south side is comprised mostly of medium low-density residential.

Within the project area, Phase 1 of the Guadalupe Mitigation Project was implemented in 1998. The Phase 1 mitigation site is located along the upper reach (Reach 4) of Guadalupe Creek, downstream from Masson Dam. Planting was implemented along 1,263 linear feet of this site in 1998 to compensate for impacts on SRA cover vegetation resulting from the construction of portions of the Guadalupe River project. The plantings were installed on both sides of the creek, 660 feet downstream from Masson Dam, and continued downstream for approximately 780 feet. Planting sites were located on existing benches and include the following species:

- Trees—*Acer negundo, Aesculus californica, Alnus rhombifolia, Platanus racemosa, Populus fremontii, Quercus douglasii, Quercus lobata, Salix lasiolepis,* and *Salix laevigata* (NOTE: *Quercus* seedlings and acorns were not available during the Phase 1 planting time and will be installed during Phase 2);
- Shrubs—*Baccharis salicifolia, Rosa californica, Salix exigua,* and *Sambucus mexicana*; and
- Herbaceous vegetation—*Artemesia douglasiana.*

Modifications to the creek as part of the project may affect the Phase 1 plantings. Phase 1 planting areas affected by modifications to the creek will be replaced at a 1:1 ratio.

3.5.1.1 City of San Jose Property

An undeveloped parcel owned by the City of San Jose (Parcel Number 2) is located on the south side of the creek in Reach 2. This reach of the creek is extremely confined by residential development on the north side of the creek and the Meridian Avenue Bridge. An opportunity may exist to obtain an easement from the City of San Jose for this parcel. Securing this parcel would allow for enlargement of the creek's floodplain and ultimate flood capacity. Expansion of the floodplain is consistent with the City of San Jose General Plan (1994), which seeks to balance the need to protect the community from the risk of flood damage with the need to protect San Jose's remaining riparian corridors. In particular, the general plan directs the City of San Jose to cooperate with the District to improve flood protection facilities.

3.5.1.2 Los Capitancillos Freshwater Wetland Mitigation Site

The Los Capitancillos Freshwater Wetland Mitigation Site is proposed on District-owned property adjacent to Reach 4 of the Guadalupe Creek project area near Masson Dam. The District is proposing to implement a wetlands mitigation project that would include the construction of a 5-acre seasonal freshwater wetland. The wetland will provide habitat for common seasonal freshwater plants and associated vertebrate and invertebrate fauna. The District-owned parcel is currently a relatively flat, open, weedy field. The schematic design phase of the project is scheduled to be completed by fall 2000. The engineer's report and the environmental documents are scheduled to be completed by fall 2001.

The preliminary design concept for the project consists of a series of interconnected wetland basins, including an upland sedimentation area. Water will flow into the southwest end of the wetland from the District's Almaden Valley Pipeline. Excess water will exit the northeast portion of the site into Guadalupe Creek. During spring and fall, and at other times during low rainfall years, water is expected to be released from the Los Capitancillos freshwater wetland into Guadalupe Creek. Because the site is located in a residential area, it is anticipated that the final design will include passive recreational features, such as a pedestrian walkway, wildlife viewing areas, interpretive signs, and vegetation barriers or fences.

Coordination is occurring between the Guadalupe Creek and freshwater wetland projects (both District projects) to ensure that the freshwater wetland will not adversely affect fish. Water use requirements for the freshwater wetland will be reviewed to ensure that water releases into the creek are not reduced and that releases will not increase water temperatures in the creek. The planning and design of the Guadalupe Creek project will occur in conjunction with the freshwater wetland. This coordination will create a unified functionality between the two projects and ensure that design features needed for the freshwater wetland, for such things as passive recreational uses, do not conflict with the Guadalupe Creek project.

3.5.1.3 Recreational Uses

Unauthorized public access occurs in the project area. Unauthorized recreational uses along the project area include jogging, walking, and bicycling along the maintenance access road; fishing in the percolation ponds; and hiking along the creek. Several footpaths (alongside and crossing the creek) are evident in the field and on aerial photographs.

3.5.2 Infrastructure

3.5.2.1 Los Capitancillos Percolation Ponds

The Los Capitancillos percolation pond system begins at Masson Dam, where water is diverted from Guadalupe Creek or the Alamaden Valley pipeline into the gallery box and is treated with a coagulant. The treated water is released into the mixing canal, located south of and adjacent to the first percolation pond. The mixed water enters the first percolation pond, the settling pond, where sediment settles before entering the next pond. The water is transported to and from each pond by a series of pipe connections and low weirs until it reaches the final pond, which is located on the east side of Almaden Expressway near the District office. Water is piped under Meridian Avenue and under the maintenance road west of Meridian Avenue to supply the group of ponds between Meridian Avenue and Almaden Expressway. Pipes are present, in some ponds, to allow diversion of overflow from the ponds into the creek.

3.5.2.2 Flood Control Project

Guadalupe Creek serves as the primary flood conveyance channel for the 15-square- mile Guadalupe Creek drainage basin. In 1973, the Central Flood Control Zone Project 30026 was constructed to increase the flood capacity of Guadalupe Creek. The flood corridor is leveed on its north side along residential development and the Los Capitancillos percolation ponds and bounded on the south side by a natural high terrace. Coleman Road runs along this terrace on the north side of the channel for approximately 7,000 feet in the project area. The flood control project involved increasing the floodplain area by offsetting the previous levee to the north along the percolation ponds and excavating the floodplain to a lower elevation. The height of the constructed levee was increased by the project. District hydraulic model results indicate that the channel has a 100-year peak flood event conveyance capacity. Channel maintenance is performed on a periodic basis to prevent sediment deposits and vegetation from reducing the flood conveyance capacity.

3.5.2.3 Roads and Bridges

The project area is bounded by three major roadways: Coleman Road, Meridian Avenue, and Almaden Expressway. Coleman Road is adjacent to and south of Guadalupe Creek and carries two lanes of traffic in both directions. Meridian Avenue transects the project area, crosses the creek, and carries two lanes of traffic in a north/south direction. The eastern edge of Meridian Avenue Bridge is located at cross section 1114 and western edge the bridge is located at cross section 1116. Almaden Expressway is the downstream and eastern boundary of the project area. Almaden Expressway also crosses the creek and carries three to four lanes (near to and where it crosses the creek) of traffic in a north/south direction. The upstream face of the Almaden Expressway Bridge is located at cross section 1010.

Maintenance access is supplied primarily by the road located on the creek's northern levee. This road is accessible by gates located on Meridian Avenue and Almaden Expressway, where they cross the creek. The levee road runs under the bridges and has several ramps throughout the project area to allow for vehicular access to the floodplain.

Critical erosion sites that threaten the adjacent roads, including the levee road, are located between cross sections 1220 and 1200 (south side), 1200 and 1190 (north side), 1185 and 1175 (south side), 1165 and 1155 (south side), 1090 and 1085 (south side), and 1045 and 1040 (north side).

A concrete floodwall is located parallel to the creek on the south side between Meridian Avenue and cross section 1105, and approximately between coss sections 1075 and 1045. The existing walls are undercut at the toe in several areas by the creek channel.

3.5.2.4 Other Utilities and Infrastructure

Most utilities within or near the project area are located near Masson Dam, whose major function is to divert water for the percolation ponds. Three Pacific Gas and Electric (PG&E) electric towers are sited just southeast of the dam. The subsurface Almaden Valley pipeline is located south of the creek, bordering on the edge of a residential community until it crosses under Coleman Road. PG&E also has an underground utility line that runs midway through the field between the creek and Coleman Road and the residential community south of the dam. Other electric utilities are located just outside the project area and border residential development to the north and south. Pipes carrying runoff from the surrounding development empty into the creek as well as overflow water from the percolation ponds. A siphon crosses the creek under the Meridian Avenue Bridge. A chainlink fence borders Coleman Road for the length of the project area, except near Almaden Expressway where the fence backs the Le Mirador Senior Apartments.

3.5.3 Public Health and Safety

3.5.3.1 Flood Control

Guadalupe Creek is a potential flooding source for the surrounding community. The District maintains 100-year flood capacity within Guadalupe Creek and maintains limited flood storage capacity in Guadalupe Reservoir by regulating outlet flows. The creek does not pose a significant threat of flooding for 100-year and more frequent flood events. Section 3.2 provides a more detailed description of the frequency of peak flows and the channel capacity.

3.5.3.2 Mosquito and Vector Control

The Santa Clara County Vector Control District (SCCVCD) has jurisdiction over mosquito and other vectors within the project area and the percolation ponds. Currently, the project area is not a source of mosquitoes and is not a focus of any control efforts by SCCVCD. Within the percolation ponds, wind action and mosquito fish (stocked by SCCVCD) effectively control mosquitoes. SCCVCD rarely uses chemical control in the percolation ponds (Martini pers. comm.). The SCCVCD expressed interest in reviewing the project design prior to construction to reduce the likelihood of producing mosquito-breeding habitat.

3.5.3.3 Mercury

Mercury is a widespread problem within the Guadalupe watershed because of historic cinnabar (mercury-bearing ore) mining in the watershed. South San Francisco Bay, Calero Reservoir, Alamitos Creek, Guadalupe Creek, and Guadalupe River, all within the Guadalupe River watershed, have been listed as impaired in the State Water Resources Control Board's 1998 303(d) list. The New Almaden Mine complex was the largest mine in the area and is located upstream from the Guadalupe Reservoir on lands owned by the Santa Clara County Parks and Recreation Department. Operated intermittently between 1854 and 1976, the Almaden Mine area drains to Los Capitancillos Creek, Almaden Reservoir, Guadalupe Reservoir, Guadalupe Creek, and Alamitos Creek (San Francisco Regional Water Quality Control Board 1998a). Additionally, the Guadalupe Mines that are located immediately upstream from the project area are at the present location of the Guadalupe Landfill (San Francisco Regional Water Quality Control Board 1998a).

Leaching of tailings and overland flow of mercury rich soils has resulted in the downstream accumulation of mercury in the Guadalupe River watershed. Mercury concentrations in sediments from different sources can vary widely. The mercury content of transported sediment in any location within the watershed will depend primarily on the source and physical properties of the sediment, its organic carbon content, and the fate and transport characteristics of mercury in the water column. Sediment could accumulate behind habitat improvement and structural components, including wetland and riparian vegetation plantings and bank stabilization structures. Methyl mercury could form in these accumulated sediments, a process that is known as methylation. The process of methylation is determined by environmental conditions, such as pH, dissolved organic carbon, temperature, sulfate, and light. Many of these physical and chemical constituents are also affected by biological factors, such as growth, decay, and other metabolic processes. Since most methylation is affected by biological factors, it is likely that methylation processes change seasonally. Projects in the Guadalupe River watershed could potentially contribute to sediment disturbance and transport processes could cause cumulative changes in the locations and rates of methyl mercury formation.

Because of the potential for formation of methyl mercury in the project area, the District initiated a sampling program to characterize the distribution of mercury in soils and sediments of surfaces that will be modified as part of the proposed project, and to identify soil disposal considerations (Tetra Tech 2000a). During June and July 2000, 50 sediment samples were collected from the proposed project site, from the proposed Los Capitancillos freshwater wetland mitigation site located on the south side of the creek adjacent to Coleman Road, and from the upstream creek segment below Camden Avenue. Table 3-15 summarizes the results of preliminary analyses of these samples.

Table 3-15. Results of June–July 2000 Mercury Analyses of Bank Soils at Proposed Project Site

Location (depth)	Surface	-6 Inches	-2 Feet	-5 Feet	-10 Feet
Reaches 1–4:					
Number of samples		26	10	2	2
Mean concentration		19 mg/kg	19 mg/kg	24 mg/kg	13 mg/kg
Highest concentration		65 mg/kg	69 mg/kg	24 mg/kg	18 mg/kg
Lowest concentration		3.8 mg/kg	0.72 mg/kg	23 mg/kg	7.6 mg/kg
Los Capitancillos Site:					
Number of samples	6	2	2		
Mean	8.5 mg/kg	6.9 mg/kg	5.7 mg/kg	N/A	N/A
Highest concentration	160 mg/kg	12 mg/kg	9.9 mg/kg		
Lowest concentration	1.1 mg/kg	1.8 mg/kg	1.4 mg/kg		

mg/kg = milligrams per kilogram
N/A = not applicable

An additional ten samples were collected in conjunction with the September 2000 water quality sampling program (six from the project site and four from upstream localities). Table 3-16 summarizes the results of analyses performed on these samples.

Table 3-16. Results of September 2000 Mercury Analyses of Bank Soils

Parameter	Minimum	Maximum	Mean
Project Reaches			
Total Mercury (mg/kg)	3.0000	27.500	11.783
Upstream Sites			
Total Mercury (mg/kg)	46.700	203.00	100.45

mg/kg = milligrams per kilogram, dry weight

The results of the June–July 2000 analyses demonstrate that mercury concentrations in bank and terrace materials vary widely between sample localities and sampling depths. Sixteen of the 40 sediment samples collected from Reaches 1–4 showed concentrations above 20 mg/kg (the total threshold limit concentration for mercury); concentrations in those samples ranged from 21 to 69 mg/kg. Along Reaches 1–4, there appears to be little to no difference in average mercury concentration between the 6- inch and 2-foot sampling depths. Sparse data collected to date suggest that mean concentrations increase at a depth of 5 feet and then decrease again at a depth of 10 feet; however, only two samples were taken at -5 and -10 feet in Reaches 1–4. One sample from the Los Capitancillos site also exceeded the total threshold limit concentration for mercury, with a concentration of 160 mg/kg. At the Los Capitancillos site, average total mercury concentrations generally decrease with increasing depth.

Results of the September 2000 analyses of bank materials from sites in and upstream from the project reaches are similar to the June–July results and confirm the variability of mercury content in Guadalupe Creek bank soils. Five of the September samples showed mercury levels in excess of the 20 mg/kg total threshold limit criterion, although only one of these was taken from the project reach. Moreover, based on the September analyses, mercury concentrations in bank materials appear to be consistently higher than those in instream sediments, although the difference between bank and instream mercury content is greater in the upstream samples (Tetra Tech 2000c).

3.6 CULTURAL RESOURCES

3.6.1 Prehistory and Ethnography

The Santa Clara Valley and surrounding areas are the traditional home of the Ohlone, who are believed to have inhabited the area since about A.D. 500. The territory of the Ohlone extended along the coast from San Francisco Bay in the north to the vicinity of Carmel in the south, and as much as 60 miles inland. Historically, the Ohlone have been called Costanoans, from the Spanish word *costaños*, meaning "people of the coast."

The Ohlone were hunter-gatherers and relied heavily on acorns and various seafoods for subsistence. They also used a wide range of other natural resources for food, shelter, and the production of material goods. These resources included: plant materials, including various seeds, berries, and roots; land and sea mammals; waterfowl; reptiles; and insects. The Ohlone are known to have made a range of lithic and bone tools, as well as balsas (small watercraft constructed of reeds), bows and arrows, cordage, sea otter blankets, and twined basketry. Minerals were used as coloring agents in body paints; hematite and cinnabar yielded red pigment and white was obtained from clay. Like many native Californians, the Ohlone practiced controlled burning to promote the growth of seed-bearing annual plants and increase the available grazing areas for deer, elk, and antelope (Levy 1978).

3.6.2 History

The Guadalupe River system is the focus around which development in the Santa Clara Valley area has prospered. When Spanish explorers traversed the area in 1769 and 1775 in search of appropriate locations for the establishment of presidios, missions, and pueblos, they followed the Guadalupe River through the Santa Clara Valley. Their path became well-traveled and is an important local link in *El Camino Real*, the historic route connecting the missions of Baja and Alta California.

3.6.3 Mining Activities

Deposits of the mercury ore cinnabar approximately 7 miles south of the City were known and used by Native Americans for red pigment. In 1824, the hill containing these deposits was prospected for silver and gold; at this time, it was known as *La Mina Santa Clara*. In 1845, Andres Castillero, intending to develop the mine, filed a claim with the Mexican government. Castillero soon discovered that the mine was a source of mercury ore (Hart 1978). The mine was renamed the New Almaden Mine and became the largest of the mines in the Guadalupe River watershed; the mine site is located on lands that are now part of the 4,000-acre Almaden Quicksilver County Park, owned by the Santa Clara County Parks and Recreation Department. Additional mines in the area included the Guadalupe Mines, located upstream of the project area. The Guadalupe Mines site is the present location of the Guadalupe landfill.

Mercury, traditionally called quicksilver, is a critical component in the gold smelting process. When the California Gold Rush created an enormous demand for quicksilver, the New Almaden Mine quickly became one of the most famous and productive mercury mines in the world, yielding approximately $1 million annually. The large mine operations required an enormous workforce, which took up residence in small townships around the mine. The New Almaden Mine continued to operate intermittently until the 1970s (Hart 1978).

Chapter 4. Restoration Project Elements

This chapter describes the restoration project elements or design criteria for the Guadalupe Creek Restoration Project. Design criteria have been developed to guide the design and implementation of the Guadalupe Creek Restoration Project. The criteria have been used to formulate alternatives, evaluate alternatives, and select and develop the preferred alternative. Design criteria are grouped by the following topics:

- Geomorphology, Hydrology, and Hydraulics
- Soils and Groundwater
- Vegetation
- Fish Habitat
- Land Use, Infrastructure, and Public Health and Safety
- Civil Engineering

4.1 GEOMORPHOLOGY, HYDROLOGY, AND HYDRAULICS CRITERIA

4.1.1 Topic 1. Channel Stability

Modifications to the creek channel and floodplain should promote long-term channel stability. Channel stability, for the purposes of this discussion, refers to the evolution of a channel that maintains relatively constant average width, depth, and sinuosity over time but does not necessarily imply a static condition at a given point on the stream. Bed stability refers to the absence of a long-term aggradation or degradation trend in the channel, though bed elevations would be expected to vary locally from year to year.

The following text outlines the geomorphic, hydraulic, and sediment- transport characteristics of the project area and identify considerations necessary to maintain long-term channel stability when creating new planting surfaces and a more complex channel geometry for improved SRA cover vegetation.

4.1.1.1 Subtopic 1A. Channel Form

The existing channel is incised in much of the project area. The incised channel form results in a narrow main channel subject to high velocities and depths during floods. Bank materials are relatively resistant to erosion and widening of the channel within the terrace surfaces created by the incision. These conditions produce high sediment transport capacities during floods, with the result that little deposition occurs adjacent to the channel or on floodplains in the project area. However, the main channel should be modified, where feasible, to reduce channel entrenchment and incision. These changes would promote a balance of erosion and deposition at elevations suitable for the establishment of riparian vegetation along the channel.

Modifying the channel and floodplain will involve changes in the width and depth of the main channel and changes in the planform of the creek, such as meander amplitude, wavelength, and radius. These characteristics, collectively referred to here as channel form, have interrelationships in fluvial systems that have been studied extensively. Empirical relations are available in the literature that relate width, depth, and meander characteristics based on measurements from a large number of streams (e.g., Leopold et al. 1964). Considerable variability exists in the data, however, and applying these relations in the design of channel modifications without carefully considering the fluvial processes in play at a particular site can lead to failure.

Design of channel modifications for the project should therefore also be based on observations from the site, Guadalupe Creek upstream from the site, and streams in similar geomorphic settings in the region. In addition, the hydraulic modeling tools developed for the project would be used to evaluate proposed designs, including their sediment transport characteristics on a reach and local level.

Action GHH1-1: *Use a combination of empirical relations, observations from the site and the region, and results of the hydraulic modeling and sediment transport computations to perform initial design of channel and floodplain modifications.*

Action GHH 1-2: *Use the hydraulic model to evaluate proposed improvements and estimate sediment transport characteristics. Combine hydraulic evaluations with anticipated benefits for SRA cover vegetation and fish habitat to refine the final design.*

4.1.1.2 Subtopic 1B. Floodplain Creation

Considerations that should guide the creation of expanded floodplains for planting surfaces include establishing more uniform sediment transport capacity between reaches, setting elevations of floodplains based on frequency of inundation, and maintaining or improving existing flood capacity. The top of existing channel depositional features in the project area correspond to discharges from 220 to 360 cfs, based on hydraulic model results and field surveyed cross sections. Return periods for the 220 cfs and 360 cfs flows at SF 43 are 1.5 years and 2 years, respectively. These return periods correlate well with averages cited in the literature for channel forming or effective discharges in alluvial channels (Leopold et al. 1964).

The discharge that inundates the top of channel depositional features at the edge of the floodplain is considered an indicator of the effective discharge. This effective discharge is considered to do the most work over time in moving sediment and forming channel bars and meanders; therefore, it is most closely associated with the morphologic characteristics of the channel (Wolman and Miller 1960, Leopold and Dunne 1978). The effective discharge has been identified as an extremely important indicator for restoration of natural channel form and stability (Rosgen 1996). The hydraulic model developed for the project and sediment transport computations permit evaluation of stability over a full range of discharges, rather than for a single indicator; however, the discharges corresponding to channel depositional features provide a starting point for estimating appropriate floodplain elevations.

Hydraulic model results show that the current channel and floodplain will convey the 100-year peak discharge. Planting vegetation to create SRA cover vegetation along the project area will result in higher channel roughness during flood flows, reducing channel capacity. Additional floodplain area will be required to compensate for this higher roughness.

Action GHH1-3: *Where feasible, reduce existing bench and slope elevations to form floodplains corresponding to 1.5- to 2-year floods.* The grading of expanded floodplains at these flood frequencies should focus on reducing the degree of stream entrenchment to values similar to those observed in areas of the project where vegetated floodplains presently exist and in the stream reach immediately upstream from Masson Dam.

Action GHH 1-4: *Where feasible, reduce bench and slope elevations to significantly increase the flood prone width for 5- to 10-year floods and greater.* This excavation is in addition to the more frequent floodplain creation described above and is primarily for the purpose of reducing velocities and channel scour during extreme events.

Action GHH1-5: *Create additional flood capacity to compensate for increased roughness by lowering the existing benches.*

4.1.1.3 Subtopic 1C. Sediment Transport Capacity

The sediment transport capacity of Reach 1 appears to be close to an equilibrium condition, where the channel is neither aggrading or degrading with time. In contrast, the channel bed in Reaches 2– 4 has degraded since 1972, and these reaches have correspondingly higher sediment transport capacities than Reach 1. In order to reduce the tendency for continued bed degradation and create a more uniform sediment transport capacity through the project area, the sediment transport capacity should be lowered in Reaches 2–4.

Action GHH1-6: *Reduce sediment transport capacity in Reaches 2–4 by lowering the level of the adjacent floodplain.* This lowering will reduce confinement of flood events and decrease velocities, depths, and shear stresses in the main channel. The associated decrease in sediment transport capacity reduces the potential for streambed degradation. The size and extent of created floodplain surfaces should be designed to produce a more uniform sediment transport capacity through the project area for 1.5-year and larger floods.

Action GHH1-7: *Construct expanded floodplains or widen the main channel at elevations that promote deposition of fine-grained sediments along the inside of channel bends and on floodplains.* Deposition of fine-grained material provides sites for natural recruitment of riparian vegetation.

Action GHH1-8: *Design the channel to transport sediment at low flows as well as during floods.* Bed and bank features will be constructed to shape the channel and maintain suitable width/depth geometry for sediment transport. Pools will be constructed to be self-scouring, using grade controls, barbs, hardpoints, rootwads, and other IWM.

4.1.1.4 Subtopic 1D. Stabilization Measures

Historically, channel planform in the project area has been relatively stable since the 1870s. Since 1972, the channel bed has shown historic stability in Reach 1, but degradation has occurred in Reaches 2–4.

Action GHH1-9: *Modify channel form and/or location to promote stability. Use a set of consistent width, depth, and meander dimensions to guide initial design in each geomorphic reach.*

Action GHH1-10: *Widen the main channel and/or expand the floodplain in specific locations within the project area where the present channel is narrow, producing high velocities and shear stresses.* A wider channel reduces localized bank erosion and promotes stability.

Action GHH1-11: *In combination with modification of the channel/floodplain geometry, install grade control features in Reaches 2–4 to stabilize the bed against future channel incision.*

Action GHH1-12: *Maintain channel sinuosity at or near historical levels, approximately 1.10, in order to preserve long-term channel planform stability.* A significant increase in channel sinuosity over historical levels will likely result in greater planform instability resulting from higher rates of bank erosion.

Action GHH1-13: *Construct bank stabilization at erosion sites adjacent to existing infrastructure, such as Coleman Road. Similarly, install bank stabilization on eroding banks where mature trees are undercut and in danger of being lost.* Potential bank stabilization techniques include the use of barbs, buried groins, hardpoints, IWM, toe revetment, and rootwads; construction of bench surfaces; and sloping of the streambanks. All of these techniques may incorporate biotechnical methods to integrate bank stabilization structures and vegetation. A definition of each application is provided at the end of this subsection. The benefits of each application are shown in Table 4-1.

Action GHH1-14: *The adjustment of channel planform should exclude the construction of tight meander bends (e.g., similar to the existing bend at station 47+00) in areas where bank migration is not acceptable.*

4.1.2 Topic 2. Channel Complexity

Efforts to increase channel complexity for fish habitat should focus on the use of localized measures, including grade controls, barbs, buried groins, hardpoints, IWM, toe revetment, and rootwads. These techniques should focus on modifications of hydraulics and channel geometry for relatively low flows, without significantly modifying overall channel sinuosity or slope. Many of these techniques would have secondary benefits to improve channel stability and create improved sites for planting, establishment, and regeneration of riparian vegetation.

Action GHH2-1: *Increase channel complexity in the project area while preserving the existing channel planform as much as possible.* In those cases where relocation of the creek channel is the preferred option, the new channel should exhibit a channel sinuosity near 1.10, similar to the existing channel. Constructed meanders should generally be gradual, with an average wavelength 8–12 times the average width of the main channel.

Action GHH2-2: *Construct pools to be self-scouring, using grade controls, barbs, hardpoints, rootwads, and other IWM.*

4.2 SOILS AND GROUNDWATER

4.2.1 Topic 1. Depth to the Water Table

The deep water table that occurs under most of the project area will constrain riparian vegetation establishment and survival. Because the water table loses elevation as it extends laterally from the main channel, the influence of this constraint on riparian vegetation establishment and survival will be more significant as the distance from and elevation above the main channel increases.

Action SG1-1: *Grade land to bring ground surface closer to water table.*

Action SG1-2: *Irrigate the planting zones until the root systems of the riparian vegetation are sufficiently developed to access the water table during the dry season.*

4.2.2 Topic 2. Coarse-Textured Soil and High Coarse Fragment Content

Soils with textures of sandy loam or coarser have relatively low available water holding capacities (AWHC) and, consequently, may not be able to provide sufficient water for the establishment and survival of riparian seedlings. Large quantities of coarse fragments may physically inhibit root growth and, in coarse-textured soils, exacerbate the low AWHC problem.

Action SG2-1: *Irrigate the planting zones until the root systems of the riparian vegetation are sufficiently developed to access the water table during the dry season.*

Action SG2-2: *Incorporate fine-textured materials (i.e., fine-grained soil, gravel, and cobbles from grading operations) into coarse-textured soils that will be planted with riparian vegetation to increase the soil AWHC.*

Action SG2-3: *Excavate planting areas with extremely coarse-textured soils below final grade and backfill with topsoil.*

4.2.3 Topic 3. Hard and Cemented Soil

Soils with hard or cemented subsoil horizons may physically inhibit root growth.

Action SG3-1: *Loosen the hard and cemented soil before planting riparian vegetation.* Areas within 15' of preservation fencing will be ripped to a 6" depth. Areas where existing soil has a low available water holding capacity will receive topsoil and will be excavated to a 6" depth; after excavation the area will be ripped to a 24" depth. Areas not receiving topsoil will be ripped to a 30" depth.

4.3 VEGETATION

4.3.1 Topic 1. Site Preparation

Existing native and nonnative vegetation is present in the project area. This vegetation will either be preserved or removed as part of site preparation activities. In addition, before planting operations can begin, surfaces suitable for revegetation will be created during earthwork operations.

Action V1-1: *Preserve existing native vegetation in the project area.* Native vegetation, including mature sycamores and willows, will be preserved to the extent feasible and protected during construction.

Action V1-2: *Transplant desired native trees and shrubs from excavation areas.* In areas that will be excavated, existing native plants will be excavated for use as transplants.

Action V1-3: *Remove invasive nonnative plants.* Existing nonnative plants will be removed (i.e., cleared and grubbed) from the project area. If necessary, herbicides will be used to remove/control nonnative plants such as cape ivy, star thistle, Himalayan blackberry, and Scotch broom.

Action V1-4: *Create suitable surfaces for revegetation.* Each plant community will require a different soil condition or distance from groundwater. Some planting areas may require that the existing, compacted soil surface be mechanically ripped. Other planting areas may need the surface excavated to establish its elevation closer to groundwater or the creek surface. In areas with cemented soils, the surfaces may need to be over-excavated and backfilled with topsoil.

4.3.2 Topic 2. Planting

The intent of planting the project area is to provide SRA cover vegetation and riparian habitat in the short term and create a self-sustaining vegetation corridor on Guadalupe Creek in the long term. The following subtopics outline the plant species composition, plant collection requirements, and installation techniques for revegetating the project area.

4.3.2.1 Subtopic 2A. Plant Species Composition

Five planting zones have been developed with an overlap in species to allow plant distributions to occur naturally under diverse microhabitat conditions: water's edge, lower slope, upper slope and lower bench, upper bench, and bar surface. Historic and prehistoric vegetation data and local reference sites were used to develop the plant associations. Plant species composition for each zone is based on site conditions with respect to geomorphic condition, soil conditions, surface water hydrology, flood return interval, and depth to groundwater. In addition, an evaluation of survival, species composition, plant height, and volunteers among the Phase 1 plantings provided insights into plants that appear to thrive at this particular site condition. Figure 4-1 graphically illustrates each zone.

Action V2-1: *Plant riparian species along the wetted perimeter of the low-flow channel (water's edge zone).* The species composition for this zone white alder, mule far, western sycamore, Fremont's cottonwood, sandbar willow, red willow, and arroyo willow.

Action V2-2: *Plant riparian species on the lower slope (lower slope zone).* The species composition for this zone consists of white alder, mule far, western sycamore, Fremont's cottonwood, sandbar willow, red willow, and arroyo willow.

Action V2-3: *Plant riparian species on the upper slope and lower bench (upper slope and lower bench zone).* The species composition for this zone consists of box elder, California buckeye, California sagebrush, mule fat, western sycamore, Fremont's cottonwood, coast live oak, valley oak, California wild rose, arroyo willow, blue elderberry, and California bay.

Action V2-4: *Plant riparian and oak woodland species on upper bench (upper bench zone).* The species composition for this zone consists of box elder, California buckeye, California sagebrush, coyote brush, coast live oak, blue oak, valley oak, California wild rose, blue elderberry, snowberry, and California bay.

Action V2-5: *Plant riparian species with IWM on bar surfaces (bar surface zone).* The species composition for this zone consists of white alder, mule fat, western sycamore, Fremont's cottonwood, sandbar willow, red willow, and arroyo willow.

Action V2-6: *Emphasize planting within 15 feet of the summer shoreline.* The intent of this zone is to maximize shade.

4.3.2.2 Subtopic 2B. Plant Collection, Propagation, Storage, and Delivery

Circuit Rider Productions has collected some plant propagation materials and the District will be growing the remaining container plants required for the project. Boxelder, California buckeye, white alder, western sycamore, Fremont's cottonwood, willows, blue oak, valley oak, Live oak, blue elderberry, mugwort, California wild rose, and mule fat have been collected from local sources (i.e., in the Guadalupe River watershed) and are being grown as container stock. The container stock will be delivered to the site once planting operations commence. In addition to these container plants, cuttings and wetland plug species will be collected as part of the construction contract. Additional plant materials would need to be collected, grown, and delivered to the site for subsequent phases of the project (e.g., future mitigation planting areas).

Action V2-7: *Collect willow and cottonwood pole cuttings.* Pole cuttings will be collected for installation on appropriate planting surfaces.

Action V2-8: *Collect plant materials from within the Guadalupe Creek watershed.* To ensure the genetic integrity of the native plant revegetation operations, all plant materials to be used for propagation or direct installation will be

PROTECTION CAGE SECURED IN PLACE WITH 2: 1"X1"X36" TREATED WOOD STAKES SET PARALLEL WITH WATER FLOW DIRECTION & SET 1/2" ABOVE TOP OF CAGE. SECURE AVIARY WIRE TO EACH STAKE WITH MIN. 3: 5/16" HEAVY DUTY STEEL STAPLES. OVERLAP AVIARY 3" MIN. & WIRE TOGETHER IN 3 PLACES MIN., TOP-CENTER-BOTTOM.

NOTES:

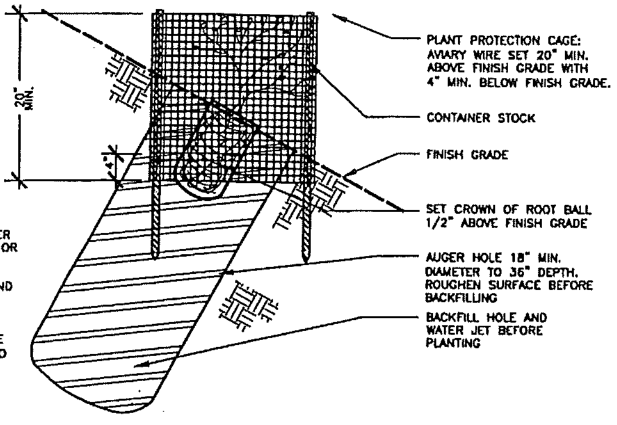
1. THIS DETAIL APPLIES TO CONTAINER PLANTING ON SLOPES GREATER THAN OR EQUAL TO 3:1.

2. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

3. AVIARY WIRE SHALL BE 1/2" WIRE MESH X 24" HT. SET AVIARY WIRE TO A 4" DEPTH.

4. SET CAGE AND STAKES VERTICAL TO SLOPE. FIELD ADJUST HEIGHT AS NECESSARY TO ACCOMMODATE SLOPES ACCORDING TO THE ENGINEER'S DIRECTION.

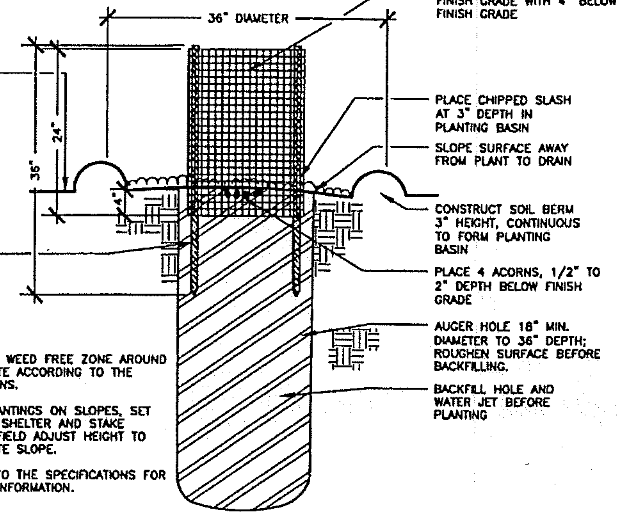
5. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.


20" MIN.
4"
PLANT PROTECTION CAGE: AVIARY WIRE SET 20" MIN. ABOVE FINISH GRADE WITH 4" MIN. BELOW FINISH GRADE.
CONTAINER STOCK
FINISH GRADE
SET CROWN OF ROOT BALL 1/2" ABOVE FINISH GRADE
AUGER HOLE 18" MIN. DIAMETER TO 36" DEPTH. ROUGHEN SURFACE BEFORE BACKFILLING
BACKFILL HOLE AND WATER JET BEFORE PLANTING

1/D-9 **CONTAINER PLANTING ON BANK**
Not To Scale

FINISH GRADE

PROTECTION CAGE SECURED IN PLACE WITH 2: 1"X1"X36" TREATED WOOD STAKES SET PARALLEL WITH WATER FLOW DIRECTION & SET 1/2" ABOVE TOP OF CAGE. SECURE AVIARY WIRE TO EACH STAKE WITH MIN. 3: 5/16" HEAVY DUTY STEEL STAPLES. OVERLAP AVIARY 3" MIN. & WIRE TOGETHER IN 3 PLACES MIN., TOP-CENTER-BOTTOM.


36" DIAMETER
36"
24"
4"
PLANT PROTECTION CAGE: AVIARY WIRE SET 20" ABOVE FINISH GRADE WITH 4" BELOW FINISH GRADE
PLACE CHIPPED SLASH AT 3" DEPTH IN PLANTING BASIN
SLOPE SURFACE AWAY FROM PLANT TO DRAIN
CONSTRUCT SOIL BERM 3" HEIGHT, CONTINUOUS TO FORM PLANTING BASIN
PLACE 4 ACORNS, 1/2" TO 2" DEPTH BELOW FINISH GRADE
AUGER HOLE 18" MIN. DIAMETER TO 36" DEPTH; ROUGHEN SURFACE BEFORE BACKFILLING.
BACKFILL HOLE AND WATER JET BEFORE PLANTING

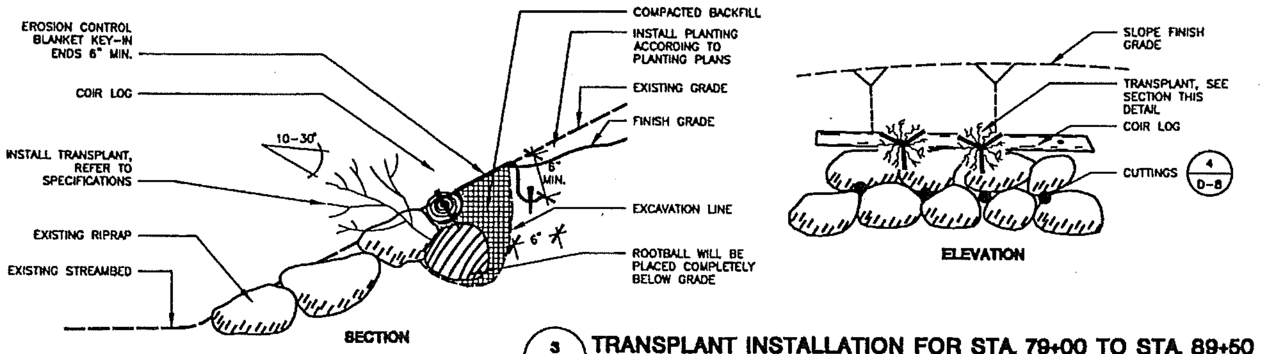
NOTES:

1. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

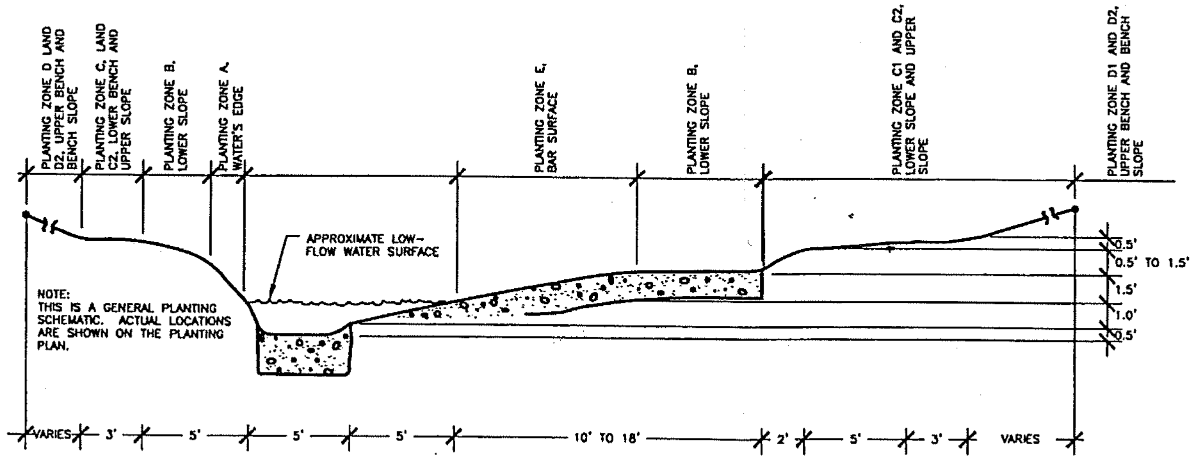
2. FOR PLANTINGS ON SLOPES, SET PROTECTION SHELTER AND STAKE VERTICAL. FIELD ADJUST HEIGHT TO ACCOMMODATE SLOPE.

3. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

2/D-9 **ACORN PLANTING**
Not To Scale


EROSION CONTROL BLANKET KEY-IN ENDS 6" MIN.
COIR LOG
10-30°
INSTALL TRANSPLANT, REFER TO SPECIFICATIONS
EXISTING RIPRAP
EXISTING STREAMBED
COMPACTED BACKFILL
INSTALL PLANTING ACCORDING TO PLANTING PLANS
EXISTING GRADE
FINISH GRADE
6" MIN.
EXCAVATION LINE
6"
ROOTBALL WILL BE PLACED COMPLETELY BELOW GRADE
SECTION
SLOPE FINISH GRADE
TRANSPLANT, SEE SECTION THIS DETAIL
COIR LOG
CUTTINGS
4/D-8
ELEVATION

3/D-9 **TRANSPLANT INSTALLATION FOR STA. 79+00 TO STA. 89+50**
Not To Scale


PLANTING ZONE D LAND D2, UPPER BENCH AND BENCH SLOPE
PLANTING ZONE C, LAND C2, LOWER BENCH AND UPPER SLOPE
PLANTING ZONE B, LOWER SLOPE
PLANTING ZONE A, WATER'S EDGE
PLANTING ZONE E, BAR SURFACE
PLANTING ZONE B, LOWER SLOPE
PLANTING ZONE C1 AND C2, LOWER SLOPE AND UPPER SLOPE
PLANTING ZONE D1 AND D2, UPPER BENCH AND BENCH SLOPE
APPROXIMATE LOW-FLOW WATER SURFACE
0.5'
0.5' TO 1.5'
1.5'
1.0'
0.5'
VARIES
3'
5'
5'
5'
10' TO 18'
2'
5'
3'
VARIES

NOTE:
THIS IS A GENERAL PLANTING SCHEMATIC. ACTUAL LOCATIONS ARE SHOWN ON THE PLANTING PLAN.

4/D-9 **PLANTING ZONES**
Not To Scale SECTION LOOKING UPSTREAM

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2580 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B
CHECKED E.W./J.Z.

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT
PLANTING DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN
SHEET D-9
46 OF 47

Jones & Stokes

Figure 4-1
Cross-Section Showing Planting Zones

Table 4-1. Benefits of Floodplain Creation and Increasing Channel Complexity

	Channel Complexity Benefits						
Technique	Creates Pool	Creates Plunge Pool	Narrows Channel Width	Provides Bank Stabilization	Provides Channel Bed Stabilization	Flood plain Creation	Promotes Deposition of Fine Sediments
Instream Techniques							
Grade Control		X			X		
Barbs	X		X	X		O	X
Buried Groins				X		O	
Hardpoints	X			O			
Instream Woody Material	X	O	X	X			X
Toe Revetment			O	X		O	
Rootwad	X		X	X		O	X
Bank Techniques							
Low Bench Surfaces				O	O	X	O
Slope Streambanks				X		X	O
Slope Revetment			O	X		O	
Biotechnical Bank Stabilization			O	X			X

Note:

O = Provides benefits when used in combination with other techniques.
X = Provides benefits when used individually.

collected from within the Guadalupe Creek watershed, unless otherwise approved by the District.

Action V2-9: *Propagate, store, and deliver plant materials.* For subsequent phases of the project, collected plant materials will be propagated and stored offsite and delivered to the project area as seedlings in containers for installation. Plants must not become heat- or water-stressed during storage and delivery operations.

4.3.2.3 Subtopic 2C. Planting Techniques

Action V2-10 *Install live-staked willows at instream features.* On streambanks, willow wattles will be used in conjunction with IWM and bank stabilization features.

Action V2-11 *Install pole cuttings.* Pole cuttings will be installed in the water's edge, lower slope, upper slope and lower bench, and bar surface zones.

Action V2-12 *Install seedlings.* Seedlings will be grown as container stock and will be planted in the native soil. Delivered seedlings must be planted as quickly as possible and stored in shade until planting. All plants will be thoroughly watered at the time of planting.

Action V2-13 *Install transplants.* Native plants excavated during earthwork operations will be transplanted to the appropriate planting zone based on the plant association of the species to be transplanted.

4.3.3 Topic 3. Irrigation

Action V3-1: *Provide irrigation to newly established plants.* Planting areas will require irrigation during plant establishment. Irrigation will be required for 2–5 years following plant installation.

Action V3-2: *Provide bubbler irrigation systems to all zones, except for the bar surface zone.*

Action V3-3: *Provide bubbler irrigation systems within the sycamore/oak woodland plant association.* On the upper terraces, a polyvinylchloride (PVC) pipe, deep watering system will provide appropriate moisture for the plant materials.

Action V3-4: *Install irrigation system water service points.* Install connections to City of San Jose water mains located near the project area, as directed by the District, to supply water to the irrigation systems.

4.3.4 Topic 4. Plant Establishment/Maintenance

Action V4-1: *Water container plants to maintain an adequate supply of moisture within the root zone.*

Action V4-2: *Control weeds.* Manual, mechanical, and/or chemical (i.e., herbicides) methods will be used to control weeds.

Action V4-3: *Avoid applying topical fertilizers.* Topical fertilizers encourage vigorous weed growth.

Action V4-4: *Repair or replace damaged project features.* Damaged project features (e.g., plants, irrigation system) will be repaired or replaced. Some plant replacement may be required to meet SRA cover vegetation requirements. It is expected that the adaptive management program will recognize any trends that may indicate that the site will not meet the measurable mitigation requirements.

4.3.5 Topic 5. Erosion Control

Action V5-1: *Seed any bare surfaces that have been exposed by construction activities.*

4.4 FISH HABITAT

4.4.1 Topic 1. Overhead Cover

Overhead cover is measured as the percentage of the total stream surface area shaded during midday (Raleigh et al. 1984). Overhead cover provides habitat for fish and other aquatic organisms and minimizes potential increases in water temperature. At maturation, trees and shrubs must shade at least 85% of streambank surface and 58% of the total stream surface area under normal summer flow conditions during the hours of 10 a.m. to 2 p.m. (U.S. Army Corps of Engineers 2000). An additional desired habitat condition beyond the MMP is shade covering over pools. The shaded area criteria is consistent with the habitat needs of steelhead and chinook salmon (Raleigh et al. 1984, 1986).

Action F1-1: *Plant fast-growing trees and shrubs within the 15-foot buffer strip of the summer low-flow channel.* Willows, cottonwoods, and alders grow quickly and provide overhead cover. They also have the ability to sprout from roots, live branches, and stems and would reestablish themselves if buried by sediment.

Action F1-2: *Grade banks adjacent to incised channel to increase floodplain area.* Created floodplain area provides additional riparian planting areas to increase overhead cover.

Action F1-3: *Install structures, such as rootwads, boulders, large wood material, and wood/boulder complexes, in the summer low-flow channel.* Structures narrow the low-flow channel and direct flow adjacent to shaded banks, increasing the percentage of shaded stream surface.

Action F1-4: *Install structures, such as rootwads, boulders, large wood material, and wood/boulder complexes, on floodplain surfaces, including exposed bars, to protect vegetation during plant establishment.* Structures on bars and in the floodplain provide sites where trees and shrubs can root and grow. Large stable pieces of wood protect established riparian plants. Bars and other floodplain features may become stable with establishment of riparian vegetation. The plant roots and stems slow velocity, causing fine sediments and organic materials to settle and improving the site for maintaining plant communities (Sedell et al. 1988).

Action F1-5: *Plant higher terrace and upland tree and shrub species to provide shade.* Higher terrace and upland trees and shrubs species are slower growing, yet provide dense long-term shade once they mature.

4.4.2 Topic 2. Instream Cover

Instream cover is an important component of fish habitat. Steelhead abundance is directly correlated with the amount of instream cover (Raleigh et al.1984). Instream cover includes undercut banks with an undercut width greater than 10 cm; roots, logs, and debris piles greater than 1000 cm^2 in surface area; and boulders and rocks greater than 20 cm in diameter. Fry prefer shallow habitat with depths less than 1 foot and velocity less than 1 foot per second (Raleigh et al.1984), generally along stream margins or in backwater pool habitat. Few fry are found greater than 1 meter from instream cover. As fish grow, habitat with higher velocity and increased depth is used, but juveniles remain associated with instream cover.

Instream cover within the mitigated reaches must exceed 10% of the total stream area at depths greater then 15cm. The 10% instream cover criterion must be met within 10 years of project implementation (U.S. Army Corps of Engineers 2000). Other desirable fish habitat improvements include cover of at least 15–25% of the total stream area for juvenile and older steelhead (Raleigh et al.1984).

Action F2-1: *Plant fast-growing trees and shrubs within the 15-foot buffer strip of the summer low-flow channel.* Vegetation increases potential for future recruitment of IWM through production and entrapment of woody debris. Riparian planting will provide future IWM within 30 years. (Swanson and Lienkaemper 1982).

Action F2-2: *Grade banks adjacent to incised channel to increase floodplain area.* Increased floodplain reduces midchannel velocity and associated bank and channel erosion during high-flow events, retaining habitat in stream cover provided by vegetation and structure along and within the low-flow channel.

Action F2-3: *Install structures, such as rootwads, large wood material, and wood/boulder complexes, along banks of the summer low-flow channel.* Structures create undercut banks, provide resting areas during high flows, improve feeding areas, and provide refuge from predators.

Action F2-4: *Install structures, such as rootwads, boulders, large wood material, and wood/boulder complexes, on floodplain surfaces, including exposed bars, to protect vegetation during plant establishment.* Structures on bars and in the floodplain provide resting areas during high flows and contribute cover to the stream channel.

Action F2-5: *Install fine woody material in conjunction with structures in the summer low-flow channel.* Fine woody material in shallow pool margin areas provide cover for steelhead and chinook salmon fry and juveniles (Raleigh et al.1984).

4.4.3 Topic 3. Pool Habitat

The restoration project would move toward desired pool habitat conditions. The optimal percentage of pool area for steelhead and chinook salmon ranges from 35 to 65% of total stream area during low-flow periods (Raleigh et al. 1984, 1986). For Guadalupe Creek, a distance of 100–180 feet, or 4–6 times the bankfull stream width, is suggested between pools. Pools differ in the amount and quality of escape cover, winter cover, and resting areas that they provide. Desirable stream habitat for steelhead and chinook salmon would have more than 20% of the pools where the pool bottom is obscured by surface turbulence or structures such as logs, debris piles, boulders, or overhanging banks and vegetation. Pools do not have to be channel spanning. Backwater pools formed by eddies and pocket pools formed behind boulders and wood in riffles provide refuge, feeding, and resting areas for adult and juvenile fish.

Action F3-1: *Plant fast-growing trees and shrubs within the 15-foot buffer strip of the summer low-flow channel.* Vegetation increases potential for future recruitment of IWM through production and entrapment of woody debris.

Woody debris causes scour and formation of pool habitat, maintaining pool abundance and diversity. Vegetation also provides instream and overhead cover in adjacent pools, improving fish habitat quality.

Action F3-2: *Install structures, such as rootwads, large wood material, and wood/boulder complexes, in the summer low-flow channel.* Numbers of pools are positively correlated with numbers of debris pieces in low gradient streams (Dulloff 1994). Structures also provide cover in pools, improving habitat quality.

Action F3-3: *Install structures, such as rootwads, boulders, large wood material, and wood/boulder complexes, on floodplain surfaces, including exposed bars, to protect vegetation during plant establishment.* Structures on bars and in the floodplain capture woody debris that would cause scour and formation of pool habitat, maintaining pool abundance and diversity.

4.4.4 Topic 4. Riffle/Run Habitat

Actions to improve riffle/run habitat conditions for steelhead and chinook salmon should create a more defined thalweg, reduce embeddedness of substrates. Restoring these features will improve anadromous fish spawning habitat, increase depth to improve passage conditions, and increase habitat diversity within riffle reaches. In addition, restoration actions would enhance food production in riffles, moving existing conditions toward velocities between 1 and 3 feet per second, depths between 0.4 and 1 foot, and gravel sizes greater than 1.28 inches (U.S. Army Corps of Engineers 2000).

Action F4-1: *Plant fast-growing trees and shrubs within the 15-foot buffer strip of the summer low-flow channel.* Vegetation stabilizes banks and low floodplains, narrowing the channel and increasing water depth and velocity. Narrow channels increase overall water depth and locally increase water velocity within riffles, improving fish passage and food production conditions.

Action F4-2: *Install structures, such as rootwads, large wood material, and wood/boulder complexes in the summer low-flow channel.* Structures would be used to manipulate channel geomorphology and maintain a narrower low-flow channel.

Action F4-3: *Grade banks adjacent to incised channel to increase floodplain area.* Increased floodplain reduces midchannel velocity and associated bank and channel erosion during high flows, retaining the low-flow channel integrity relative to width and depth.

4.4.5 Topic 5. Water Temperature

As mitigation for the Guadalupe River Project, the MMP measurable objective for thermal suitability indicator for anadromous fish habitat requires that total monthly thermal suitability units for steelhead and chinook salmon life stages under postproject conditions equal or exceed preproject thermal suitability units within 40 years of project construction. Calculation of thermal suitability units includes the Guadalupe River Project area as well as Guadalupe Creek and Reach A. The difference between preproject thermal suitability units and postproject thermal suitability units must indicate a decreasing trend by the tenth year (U.S. Army Corps of Engineers 2000). Stream temperature would be reduced by increasing shade/canopy coverage over the stream, increasing average depth, decreasing average width, and increasing average flows.

Action F5-1:	*Plant fast-growing trees and shrubs within the 15-foot buffer strip of the summer low-flow channel.* Trees and shrubs near the summer low-flow channel will begin to provide shade and cool water temperature sooner than trees and shrubs set back from the channel.
Action F5-2:	*Grade banks adjacent to incised channel to increase floodplain area.* Created floodplain area provides additional riparian planting areas to increase overhead cover and the resulting shade.
Action F5-3:	*Install structures, such as rootwads, boulders, large wood material, and wood/boulder complexes, in the summer low-flow channel.* Structures narrow the channel and direct flow adjacent to shaded banks, increasing the percentage of shaded stream surface. The narrower channel also increases depth, reducing maximum daily water temperatures.
Action F5-4:	*Install structures, such as rootwads, boulders, large wood material, and wood/boulder complexes, on floodplain surfaces, including exposed bars, to protect vegetation during plant establishment.* Structures on bars and in the floodplain provide sites where trees and shrubs can root and grow. Increased vegetated banks would provide additional shaded stream surface.
Action F5-5:	*Plant higher terrace and upland tree and shrub species to provide shade.* Higher terrace and upland trees and shrubs species are slower growing, yet provide dense long-term shade once they mature.

4.5 LAND USE, INFRASTRUCTURE, AND PUBLIC HEALTH AND SAFETY

4.5.1 Topic 1. Land Use

Action LU1-1	*Obtain flood easement or purchase parcel from the City of San Jose.* Securing this parcel would allow for the enlargement of the creek's floodplain and ultimate flood capacity.
Action LU1-2	*Coordinate between the Guadalupe Creek Restoration Project and the Los Capitancillos Freshwater Wetland Mitigation Project to ensure that a unified functionality is created between the two projects.*

4.5.2 Topic 2. Existing Facilities

Action LU2-1:	*Identify facilities to be protected and accurately locate these facilities during final design.* Facilities that will be identified include percolation pond and water management system improvements, flood control project improvements, roads and bridges, and underground utilities.
Action LU2-2:	*Protect or relocate existing drainage outfall structures, percolation pond piping, and percolation pond levees.*
Action LU2-3:	*Construct bank protection in areas where the creek presently threatens Coleman Road using engineering criteria for long-term performance in preventing erosion and bank migration.* While these methods may still incorporate biotechnical methods, these areas will be designed to a higher standard of erosion prevention and longer service life than other areas of the project.
Action LU2-4:	*Provide a planted buffer, where possible, between roads and the creek.*
Action LU2-4:	*Demolish existing infrastructure in excavation areas.* Existing structures, such as concrete slope protection, will be removed in the floodplain expansion areas.

4.5.3 Topic 3. Public Health and Safety

4.5.3.1 Subtopic 3A. Flood Control

Guadalupe Creek serves as the primary flood conveyance channel for the Guadalupe Creek drainage basin.

Action LU3-1:	*Maintain or improve existing flood capacity.* Modifications may be required to compensate for increased roughness due to vegetation.

4.5.3.2 Subtopic 3B. Mosquito and Vector Control

Action LU3-2:	*Review the final design of the creek with the Santa Clara County vector Control District (SCCVCD) to ensure the design does not increase mosquitos and other vectors in the project area.*

4.5.3.3 Subtopic 3C. Toxic Constituents – Mercury

During construction of the Guadalupe Creek project, a Soil Management Plan will be implemented to minimize discharges of mercury-laden sediments during construction activities.

Action LU3-3:	*Sample material grubbed, scraped, and excavated from the channel bed and banks for total mercury and methyl mercury concentrations at a rate of one sample for every 2,500 cubic yards of material removed.*
Action LU3-4:	*Prohibit the reuse of material (i.e., material grubbed, scraped, and excavated from the channel bed and banks) onsite in active channel areas (up to 5-year floodplain) unless it can be demonstrated to contain less than 0.1 milligram/kilogram total mercury.* If soil is to be disposed of offsite, the material will be hauled to an accepting location or facility from which it would not be transported back to the Guadalupe River system or into San Francisco Bay.
Action LU3-5:	*Dispose of soil contaminated by mercury based on sampling results.* Soil with greater than 20 milligrams/kilogram will be handled and disposed of as hazardous material.
Action LU3-6:	*Minimize the potential for the formation of deep (greater than 4 feet) pools to minimize the potential for methyl mercury formation.*

Action LU3-7: *Minimize the amount of wetland vegetation (emergent and aquatic species) to minimize the potential for methyl mercury formation.* Plant woody species to provide shade to discourage wetland vegetation growth.

4.6 CIVIL ENGINEERING

4.6.1 Topic 1. Design Standards

The project includes grading and channel stabilization work designed to meet the MMP measurable mitigation objectives for improved SRA cover vegetation and fish habitat. In addition, the District has identified an objective to restore physical and ecological functions in the project area. Traditional engineering design standards are generally based on static performance criteria (i.e., bank protection would be considered successful if no additional bank erosion occurs after the project is constructed). In contrast, an emphasis on process restoration implies a more dynamic performance standard. In addition, rather than a defined service life, the project should be designed to evolve towards a condition of equilibrium that limits required maintenance.

The project will include installation of IWM and other channel and bank features that will be constructed of wood. Normal fluvial processes would transport these materials at very slow rates. The postconstruction management activities associated with these process will be identified in the design process.

Action CE1-1: *Design the project to evolve over time, recognizing that bank erosion and deposition are normal fluvial processes.* Designs for installed channel features should not necessarily attempt to create static conditions, unless required to protect infrastructure.

Action CE1-2: *Identify management activities associated with anticipated changes in the project area due to fluvial processes.* Design the project such that management activities are eventually similar to those used by the District for natural streams with higher levels of riparian vegetation and instream wood.

4.6.2 Topic 2. Construction Planning

Action CE2-1: *Consider environmental regulations, potential construction impacts, and weather for construction sequencing and phasing.* It will be necessary to ensure that adequate stockpile and staging areas are available to provide operational flexibility for the contractor in meeting schedules and phasing various elements of the work.

4.6.3 Topic 3. Traffic Control and Access to Work

Access to the project site will be required for construction equipment, contractor's employee vehicles, and delivery and removal of construction materials. A large amount of excavated soil will require export and disposal offsite, which will require traffic and dust control provisions.

Action CE3-1:	*Prepare a traffic control plan to prevent traffic conflicts and damage to existing public roads.* A traffic control plan, prepared by the District, will be incorporated into the plans and specifications for the project.
Action CE3-2:	*Identify suitable sites, if available, for disposal of excavated material.* District needs for soil materials on other projects will be considered.
Action CE3-3:	*Limit truck access to the site, if extensive material delivery or export is required, to Almaden Expressway to avoid traffic conflicts on Meridian Avenue.* Other vehicles will be allowed to enter and exit the site from the southbound lane of Almaden Expressway, to exit from the maintenance road gate on the west side of the Meridian Avenue Bridge, and to enter the site from the levee gate on the east side of Meridian Avenue Bridge. Construction traffic will be prevented from entering adjacent residential neighborhoods.
Action CE3-4:	*Designate limited access routes to the creek to avoid impacts to existing vegetation, SRA cover vegetation, and aquatic habitat.* If required, creek crossing locations and temporary facilities necessary to protect the channel during construction will be designated.
Action CE3-5:	*Prepare a dewatering plan for the creek to allow work to be accomplished in the dry.* Water diversion with the District will coordinated to maintain flows in the creek upstream from Masson Dam. Where necessary, equipment will be moved along the bed of the stream for access to the work without damaging bank vegetation. Creek bed in areas used for access will be restored.

4.6.4 Topic 4. Earthwork

Action CE4-1:	*Import material that is suitable for use as topsoil within the project.*
Action CE4-2:	*Import cobble and gravel material for use in constructing relocated portions of the channel.*

Action CE4-3: *Overexcavate floodplains where required for replacement of a topsoil layer; overexcavate created channel bed where necessary to provide allowance for scour in bed materials.*

Action CE4-4: *Use slopes of 3 horizontal to 1 vertical (3:1) or flatter wherever possible in grading associated with expanding the floodplain.* Where necessary to avoid impacts to existing vegetation, biotechnically stabilized slopes will be used at no steeper than 1.5:1. Slopes for constructed bar surfaces will be used that match observed bar morphology in the project area and in the stream reach upstream from Masson Dam. Channel banks on the outside of bends will be allowed to remain vertical or nearly vertical, but slope height will be reduced based on geomorphic and hydraulic criteria for expanding the floodplain.

Action CE4-5: *Consider potential methods for constructing undercut banks, including excavation in resistant bank materials, installation of structures at the toe of the bank, and construction of a resistant undercut toe using cemented native materials.*

Action CE4-6: *Minimize cuts into existing slopes for installation of bank structures, especially on slopes adjacent to Coleman Road or other infrastructure.*

Action CE4-7: *Design bank and channel stabilization and fish habitat features to provide areas for replacement of existing coarse-textured, compacted, or cemented soils with soils more suitable for planting.*

Action CE4-8: *Salvage soils excavated onsite that have concentrations of total mercury (less than 20 miligrams/kilogram) for use as levee fill or in other areas outside of the active channel (5-year floodplain).*

4.6.5 Topic 5. Temporary Erosion Control

Action CE5-1: *Prepare a Stormwater Pollution Prevention Plan for approval by the Regional Water Quality Control Board and indicate required temporary erosion control measures in the plans and specifications.*

Action CE5-2: *Identify contingency and remedial erosion control measures in the event that unanticipated delays occur in the construction schedule or minor erosion problems occur during or immediately after construction.*

4.6.6 Topic 6. Stream Diversion

Construction activities performed in the channel will require stream diversion. Diversion of the entire stream through the percolation ponds is feasible using existing District water management facilities. This diversion would allow the creek upstream from Masson Dam to continue to flow at low levels (e.g., 5 cfs) during construction. The stream diversion will affect District water management operations during the construction period. In addition, the project includes modifications to the existing percolation ponds or other water management facilities; temporary facilities will be required to allow stream diversion through the percolation pond system.

Action CE6-1: *Dewater the creek during instream construction by diverting flows from Guadalupe Creek into the percolation ponds at Masson Dam.* Prior to diversion, fish and other animals will be removed from the creek and relocated. Dewatering will occur gradually to allow monitoring of the creek during this period for removal of remaining fish and animals.

Action CE6-2: *Identify methods for rewatering the creek following construction to minimize transport of fine sediments downstream.* Potential methods might include installing temporary gravel dams in the channel, pumping to temporary detention ponds, or pumping to provide controlled irrigation of floodplain surfaces. Suitable methods will depend to some extent on construction phasing and anticipated weather and reservoir operations.

Chapter 5. Project Alternatives and Recommended Project

This chapter describes alternatives for establishing riparian and SRA cover vegetation and improving aquatic habitat in the Guadalupe Creek project area, including the proposed project. Descriptions of each alternative including proposed restoration elements, earthwork, and estimated costs are provided below on a reach by reach basis. An overview of the reach locations is shown in Figure 5-1. A draft submittal plan set (July 17, 2000) for the proposed project is provided in Appendix C. Two additional plan view illustrations (Sheets 6-16 and 6-17 of Appendix C) are provided for Reach 4; these sheets depict revisions to the grading plans for the Los Capitancillos Wetland Mitigation Development Site (Sheets 6-12, 6-13 and 6-14) and the maintenance road levee adjacent to percolation pond 1 (Sheet 6-12). These revisions are based on comments received from District staff on the draft submittal plan set.

5.1 ALTERNATIVES CONSIDERED

Alternatives for the Guadalupe Creek Restoration Project were developed based on an extensive and thorough screening process. During the planning phase of the project, project objectives were developed to guide the alternatives development process and to screen out possible alternatives that were infeasible or would not result in the implementation of a viable, self-sustaining project. The formulation, evaluation, and selection of practicable alternatives were based on an assessment of (1) their ability to meet stated project objectives; (2) potential long-term environmental, economic, and social impacts; and (3) issues and concerns raised during the scoping process by various resource and regulatory agencies and other interested parties and individuals.

5.1.1 Alternative 1: Channel and Floodplain Modification Alternative

The Channel and Floodplain Modification Alternative emphasizes modifying channel and floodplain surfaces by channel relocation, floodplain development, and bank stabilization to enhance instream habitat and create conditions suitable for the establishment and long-term viability of SRA vegetation. Under Alternative 1, floodplain excavation would extend beyond the 15-foot planting zone (relative to the low-flow channel) to compensate for reduction in flood conveyance capacity associated with planting riparian vegetation. Implementation of this alternative would involve shifting approximately 2,500 linear feet of existing stream channel, excavating and removing approximately 42,000 cubic yards of material and importing 13,000 cubic yards of material to create suitable planting sites. In addition, approximately 725 linear feet bank protection features would be installed, and approximately 6 acres of riparian vegetation and 13,000 linear feet of SRA cover vegetation would be established under Alternative 1. Specific project features associated with this alternative are described below on a reach-specific basis. Plan view illustrations for each reach and a typical cross-section is shown on Figures 5-2, 5-3, 5-4, 5-5 and 5-6.

5.1.1.1 Reach 1

In Reach 1, the proposed project will emphasize planting existing surfaces, including bars, and minimizing physical modifications to the channel and floodplain. However, portions of the existing channel will be shifted to create new floodplain surfaces for planting along Coleman Road and to protect the maintenance road levee from further erosion.

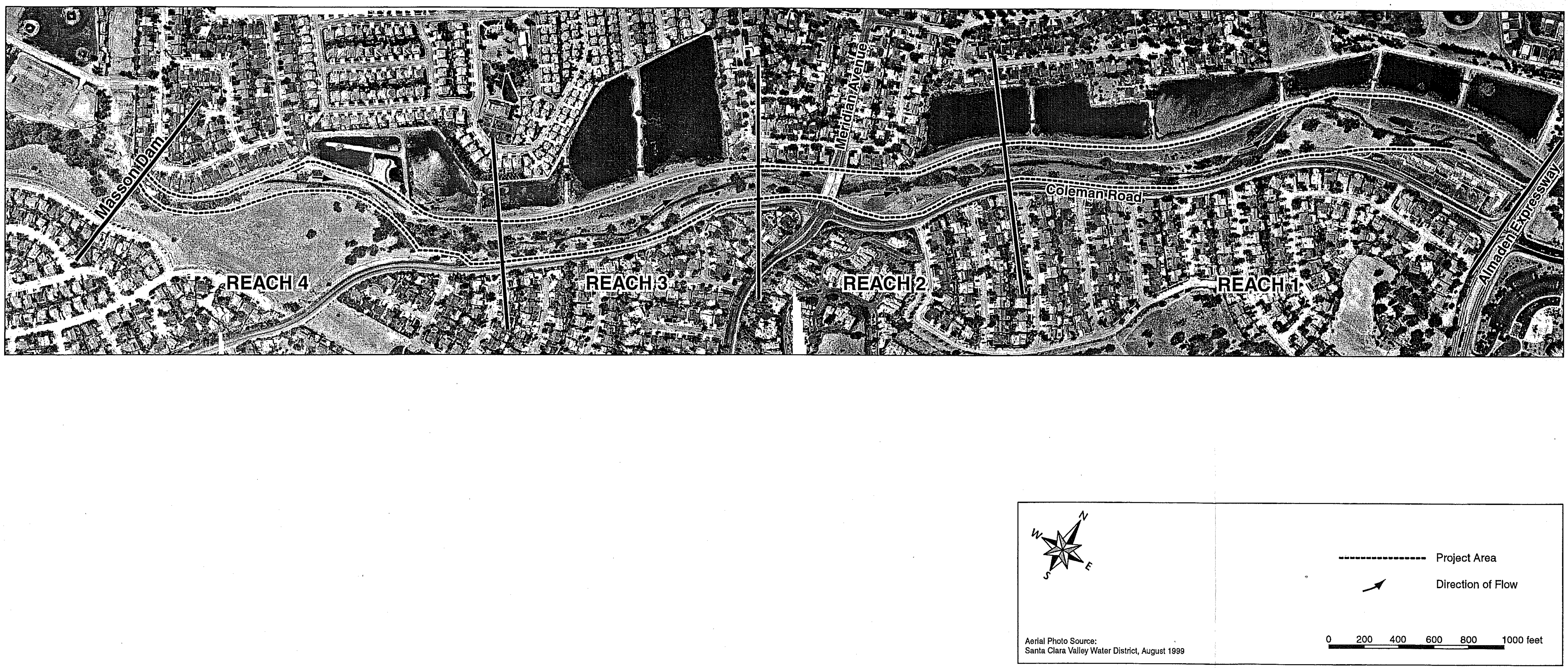
Instream structures (e.g., rootwads and other instream woody material (IWM), stream barbs, boulders, and v-weirs) will be incorporated into the channel bed and banks to control existing erosion, narrow the low-flow channel, provide cover and instream habitat for fish, and improve hydraulic diversity while maintaining the low sinuosity of the existing planform. Rootwads, barbs, and similar features will also be used to stabilize the bench along Coleman Road and to provide instream cover for fish.

The planting program for Reach 1 will emphasize planting sycamores and other riparian vegetation on floodplain and bar surfaces to create a strip of riparian vegetation along the north bank, and to fill gaps in the existing riparian canopy. The bench at the toe of the slope along Coleman Road will also be planted with riparian species. Oak woodland species will be planted at relatively low elevations where soils are coarse and permeable and contain less moisture. Immediately upstream from the Almaden Expressway Bridge, planting areas will be tapered to ensure that the bridge opening is unobstructed, and existing access to the bridge will be maintained to facilitate maintenance activities.

5.1.1.2 Reach 2

The existing planform of the creek will generally be maintained in Reach 2. Minor modifications will be made to lower floodplains in most areas, except downstream from the Meridian Avenue Bridge, where more extensive excavation will expand the floodplain on the parcel owned by the City. This expansion will reduce the flow velocity in the main channel while preserving a band of willows along the south bank. An existing sycamore tree at the top of the bank will be removed to allow for the expansion of the floodplain. An existing oak in the same area may also be removed.

Instream structures will also be installed in Reach 2. IWM will be used to improve bank stability, to increase instream cover, and to increase channel complexity and hydraulic diversity in the low-flow channel. Bank stabilization structures will be used on the bend upstream from Meridian Avenue to protect the maintenance road and improve instream cover. Near the downstream end of Reach 2, bank stabilization measures will be installed at the toe of the bank adjacent to Coleman Road.



Aerial Photo Source:
Santa Clara Valley Water District, August 1999

Jones & Stokes

Figure 5-1
Delineation of Geomorphic Reaches in Guadalupe Creek Project Area

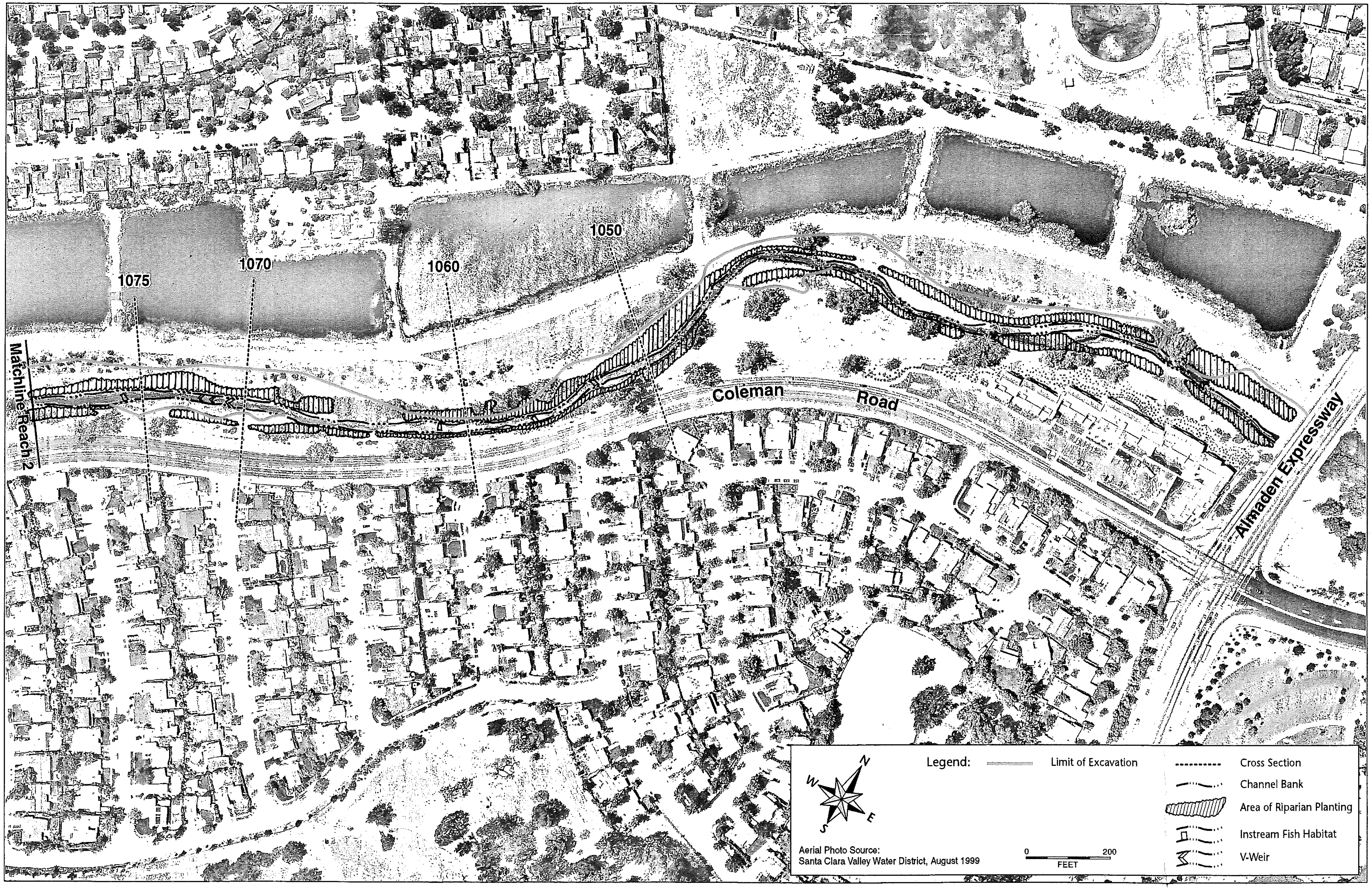


Figure 5-2
Alternative 1 - Reach 1

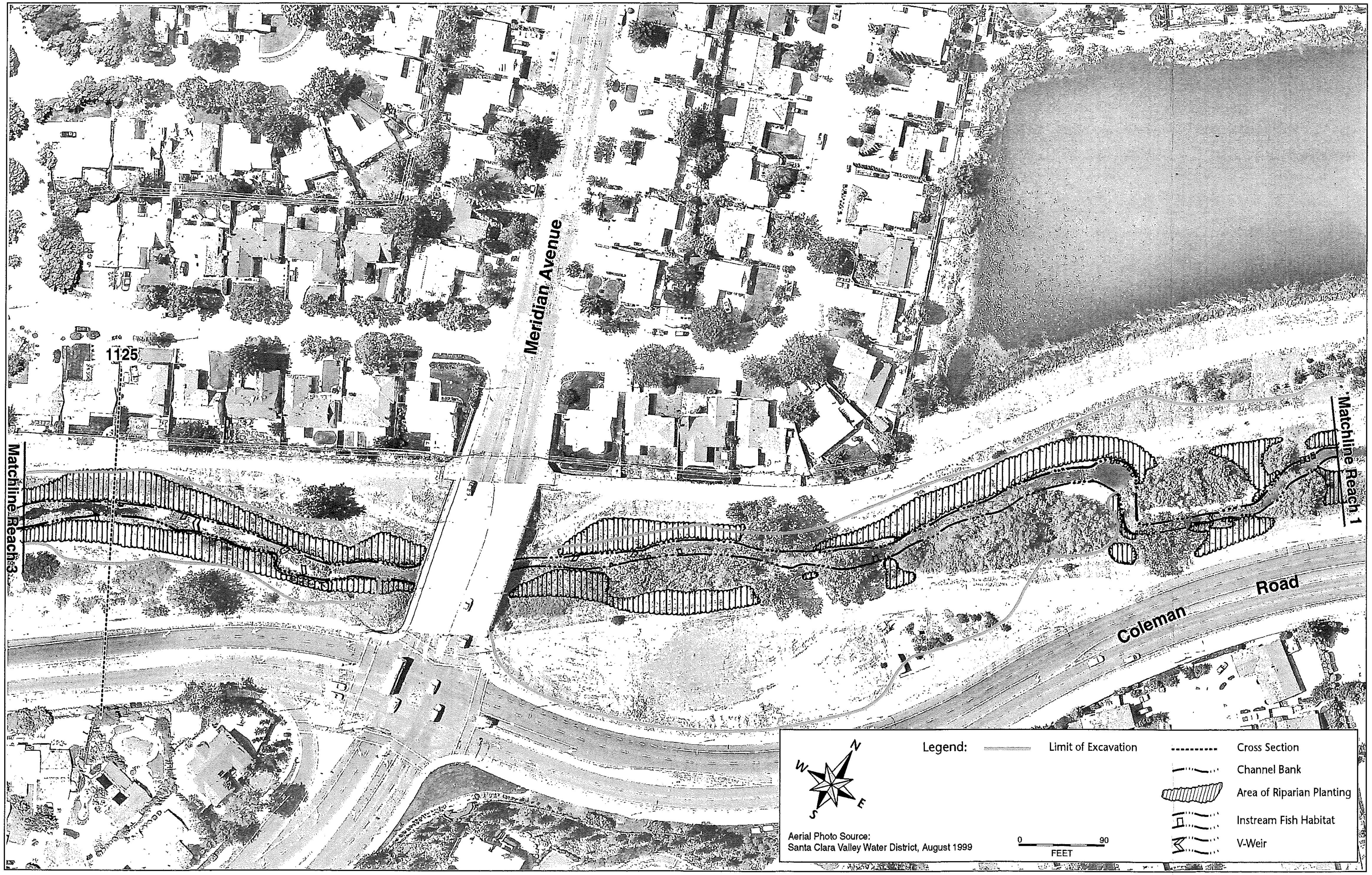
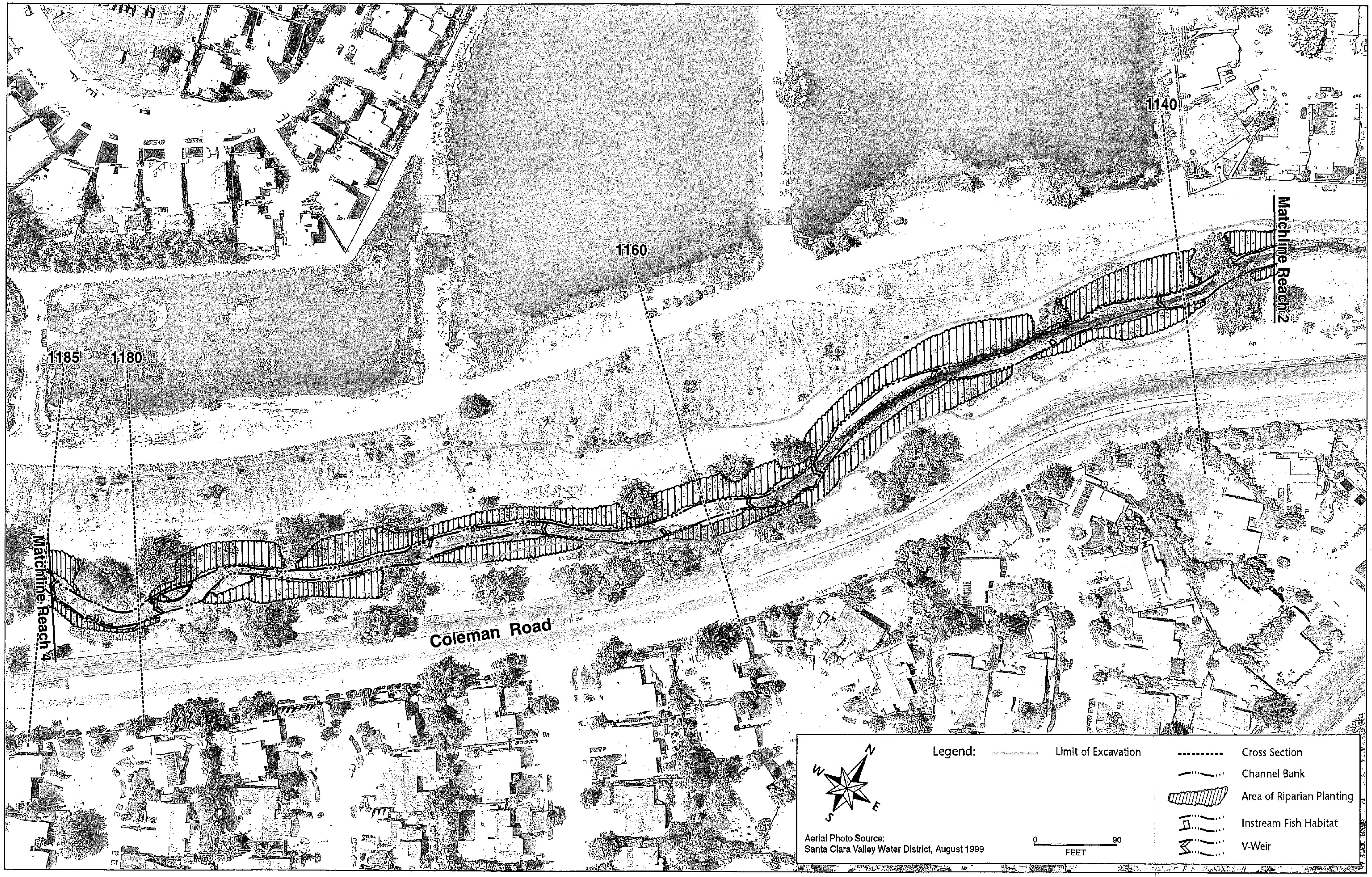


Figure 5-3
Alternative 1 - Reach 2



Aerial Photo Source:
Santa Clara Valley Water District, August 1999

Figure 5-4
Alternative 1 - Reach 3

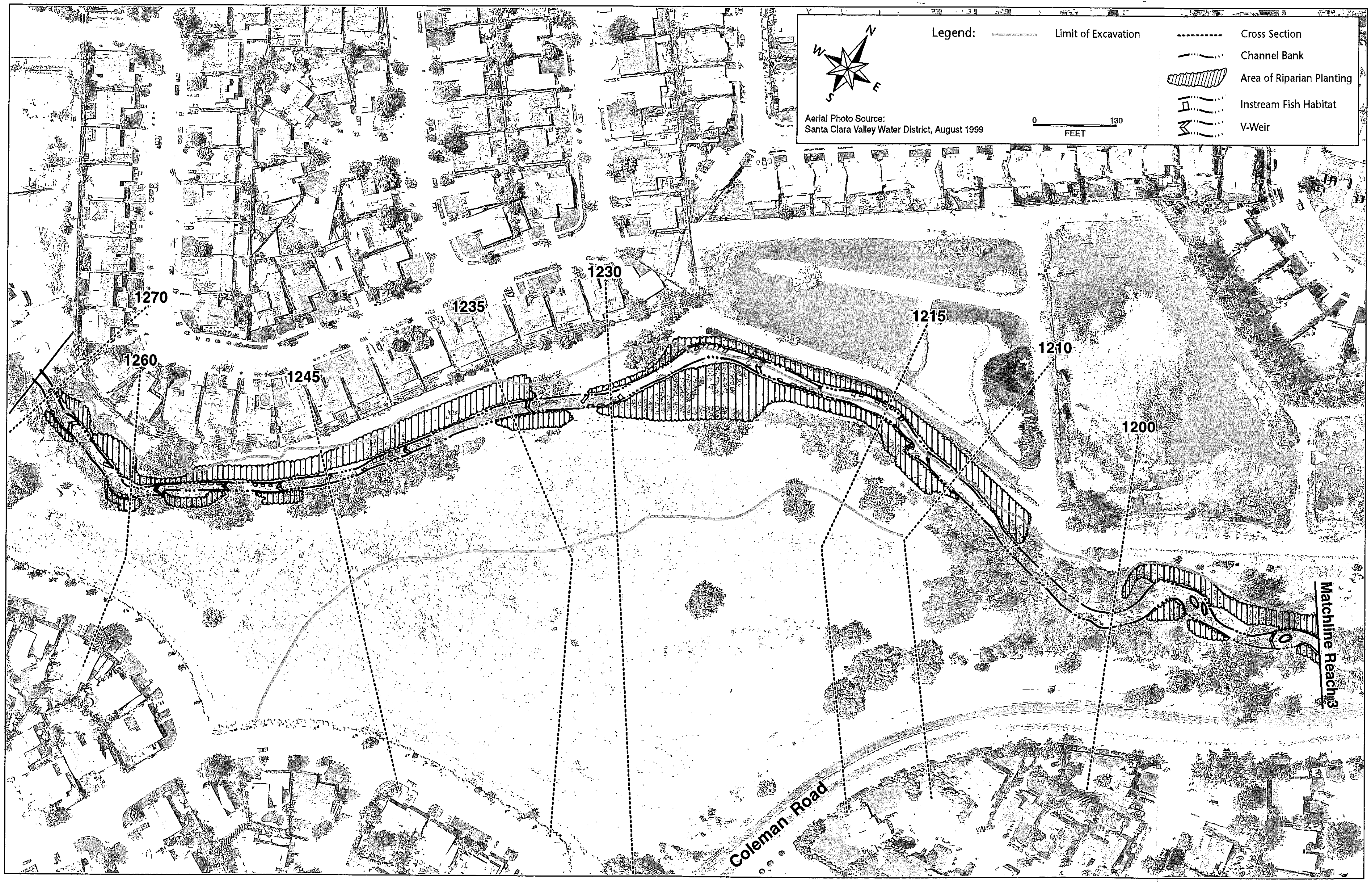
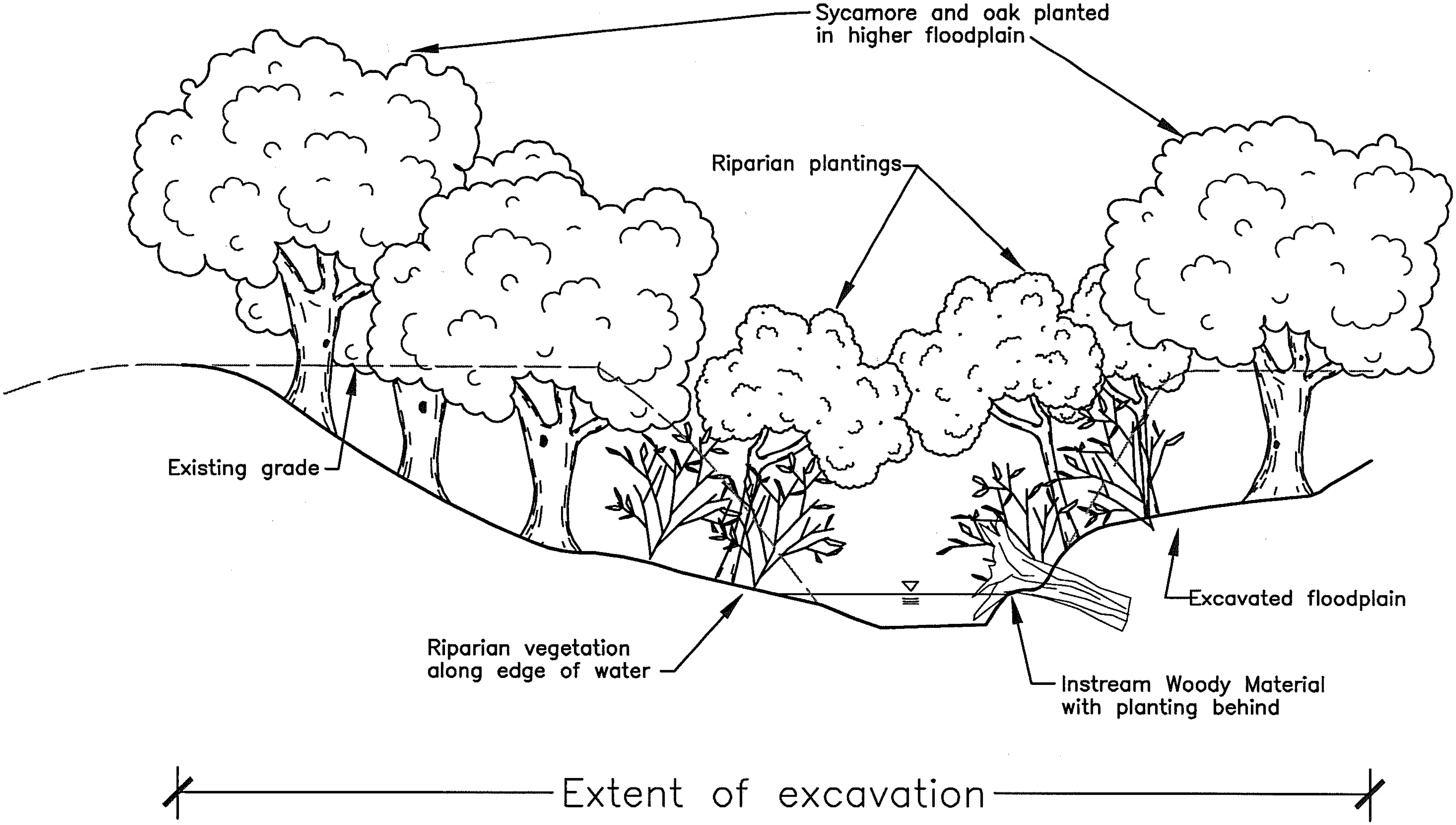


Figure 5-5
Alternative 1 - Reach 4



Jones & Stokes

Figure 5-6
Alternative 1 - Typical Cross Section

Planting in Reach 2 will include establishing riparian vegetation on the lower floodplain surfaces and higher slopes and terraces. Immediately upstream and downstream from the Meridian Avenue Bridge, the planting areas will be tapered to ensure that the bridge opening is unobstructed. Sycamore woodland species will be planted on the north side of the creek immediately upstream from the bridge to ensure that the plantings do not impede floodflows.

5.1.1.3 Reach 3

Project features proposed for Reach 3 will focus on modifying the existing channel and floodplain to reduce the level of entrenchment, providing planting surfaces for riparian vegetation, and increasing hydraulic diversity in the channel. Near the downstream end of the reach, modifications will be made to the channel planform to extend the floodplain and increase channel complexity and hydraulic diversity. These modifications will generally follow the same meander pattern that now exists in the upstream portion of the reach. Channel realignment will significantly expand the area suitable for planting riparian vegetation. Two mature sycamores, located on artificially created mounds and isolated from the active floodplain, will be removed to create additional floodplain surfaces to reduce channel velocities. IWM will be added to stabilize the bed and banks, to increase cover, and to increase channel complexity and hydraulic diversity. Woody material will also be placed on the bar surfaces in Reach 3 to stabilize the bars and provide additional planting sites.

The planting program in this reach will focus on planting riparian vegetation on expanded floodplain surfaces, in areas where the channel has been relocated, and on sites created by the installation of bank structures and placement of IWM on the backs of bars. Oak woodland species will be planted on the higher surfaces to fill gaps between existing vegetation.

5.1.1.4 Reach 4

In the downstream segment of the reach, significant SRA cover vegetation already exists and fish habitat values are high. Minimal modifications will be made to the channel in this portion of Reach 4. Woody material will be placed in an existing erosion cusp to protect the maintenance road, shelter young riparian vegetation, and provide additional planting sites.

Downstream from Percolation Pond 1, which serves as a settling basin for the percolation pond system, approximately 350 feet of the existing maintenance road will be shifted to the north to create a wider bench adjacent to the channel. This shift will increase flood conveyance capacity and provide a buffer to protect the road from bank erosion.

In the area adjacent to Percolation Pond 1, the channel will be relocated north to reoccupy a historical channel alignment. Two existing sycamores may be affected by the channel alignment. Approximately 600 feet of new channel will be created. This realignment will require relocating the maintenance road approximately 10 feet to the north, and filling the existing channel to create a new floodplain. Percolation Pond 1 will not be modified. These actions will lengthen the channel and increase instream cover and channel complexity. The channel alignment will use existing mature trees to shade the new stream surface. Existing Phase 1 plantings affected by the channel realignment will be transplanted in appropriate areas.

In the upstream segment of Reach 4, the floodplain will be expanded. On the south side of the channel, a broad lowered floodplain surface will be graded along the stream at the edge of the Los Capitancillos Freshwater Wetland Mitigation Site. On the north side of the channel, the width of the maintenance road will be reduced to 25 feet to create a floodplain bench. In addition, some of the existing riprap along the north bank will be removed.

The planting program in Reach 4 will focus on planting riparian vegetation and oak woodland species on created surfaces. Along the south bank of the creek, existing riparian vegetation upstream will be preserved. Additional project features that will be implemented in Reach 4 include installing IWM to provide planting sites on bar surfaces and installing rootwads and other structures to stabilize the outside banks of meander bends and to create instream cover.

5.1.1.5 Cost

The estimated cost of Alternative 1 is $8,492,550. A detailed breakdown of costs associated with this alternative is provided in Chapter 7 and Appendix D.

5.1.2 Alternative 2: Reduced Channel and Floodplain Modification

The Reduced Channel and Floodplain Modification Alternative (Alternative 2) would incorporate many of the restoration features specified for the proposed project. However, under Alternative 2 excavation would focus on the 15-foot zone adjacent to the low-flow channel and the number of proposed channel shifts would be reduced relative to Alternative 1. Planting densities would also be reduced to compensate for reduced flood conveyance capacity. Implementation of this alternative would involve shifting approximately 1,200 linear feet of existing stream channel, excavating and removing approximately 31,000 cubic yards of material and importing 11,500 cubic yards of material to create suitable planting sites. In addition, approximately 1,095 linear feet bank protection features would be installed, and approximately 4 acres of riparian vegetation and 9,500 linear feet of SRA cover vegetation would be established under Alternative 2. Specific project features associated with this alternative are described below on a reach-specific basis. Plan view illustrations for each reach and a typical cross section is shown on Figures 5-7 through 5-11.

5.1.2.1 Reach 1

In Reach 1, Alternative 2 will emphasize planting existing surfaces within the 15-foot zone adjacent to the low-flow channel, and minimizing physical modifications to the channel and floodplain. However, portions of the existing channel will be shifted to create new floodplain

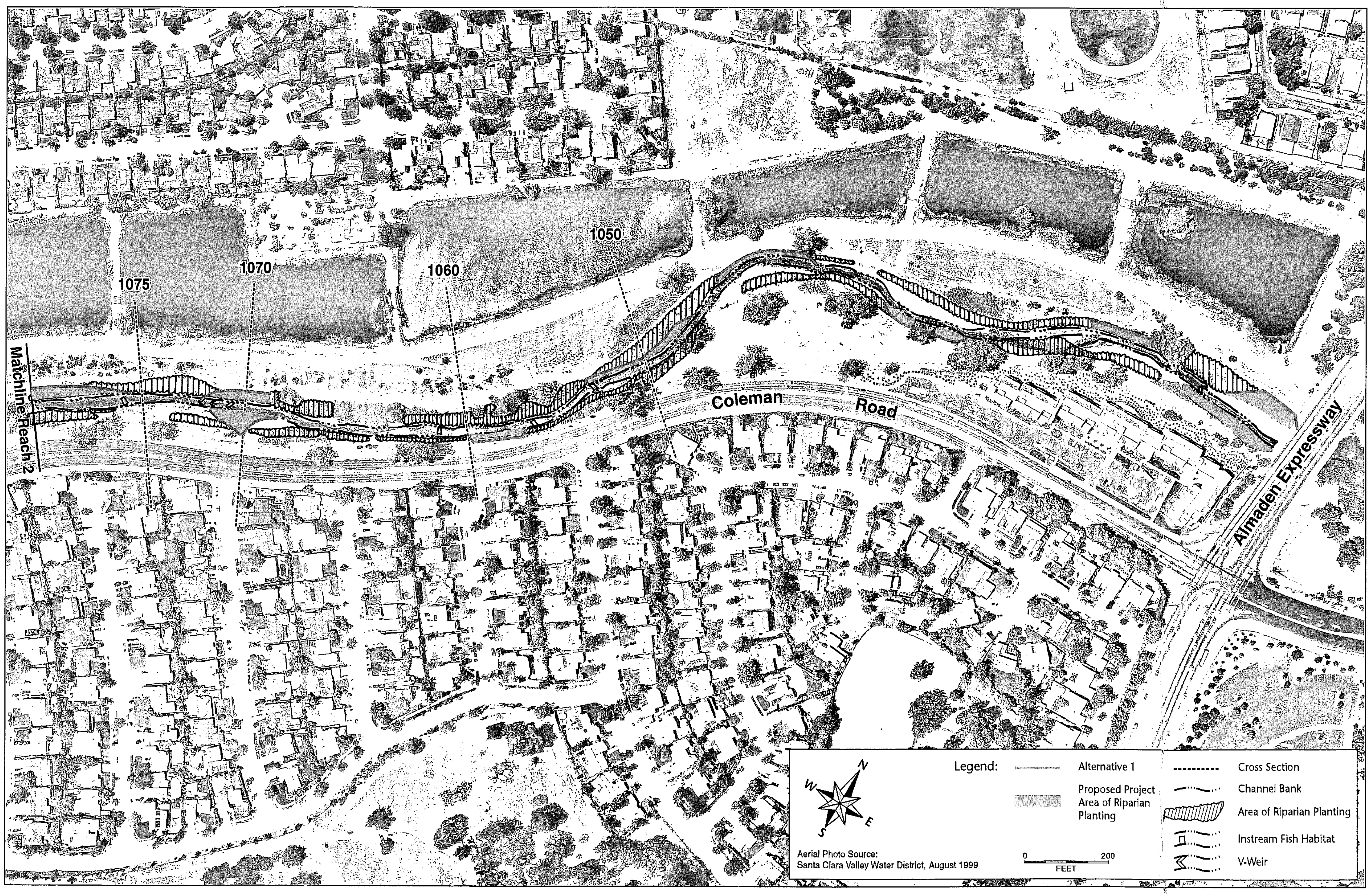
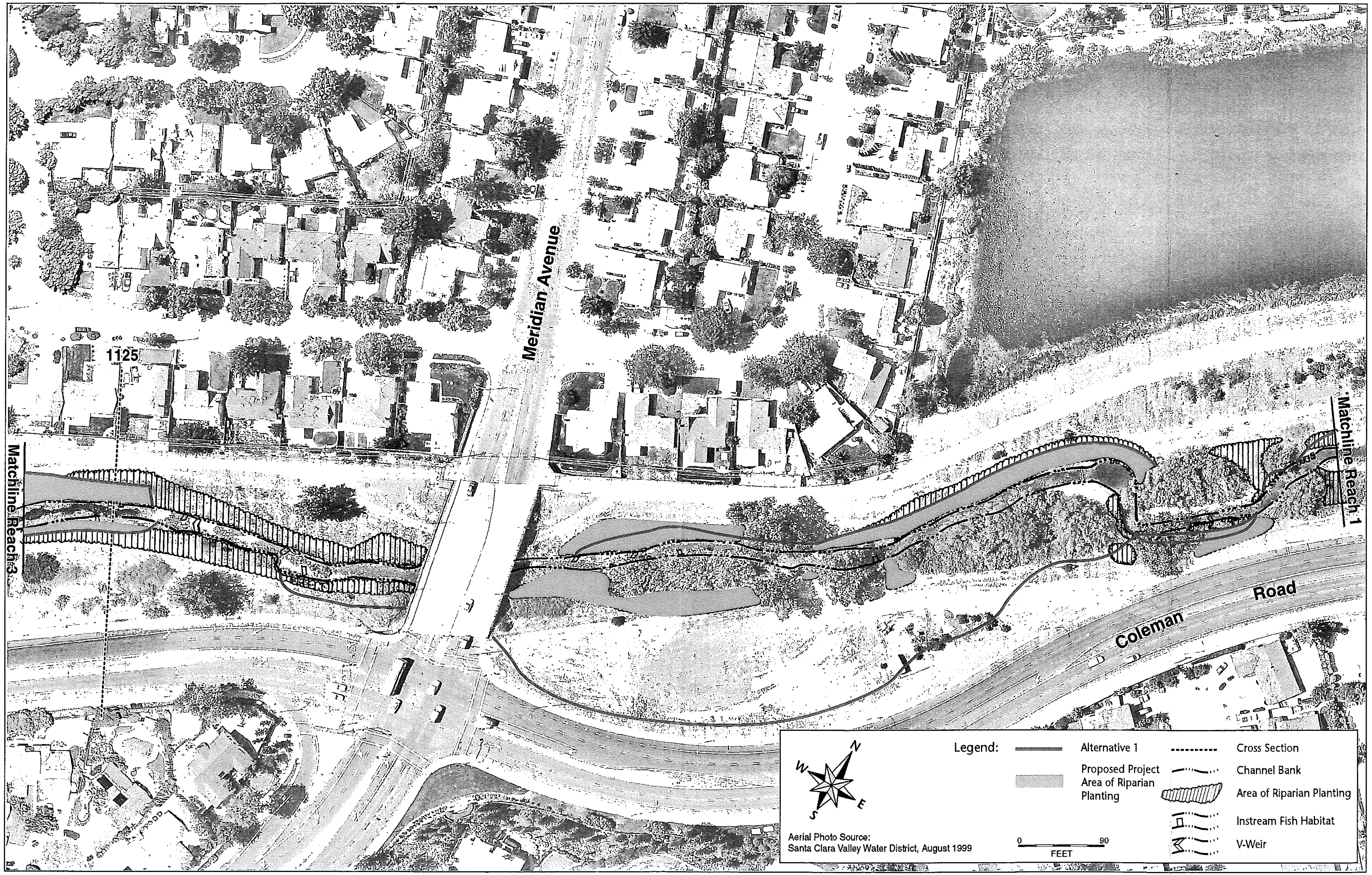


Figure 5-7
Alternative 2 - Reach 1



Jones & Stokes

Figure 5-8
Alternative 2 - Reach 2

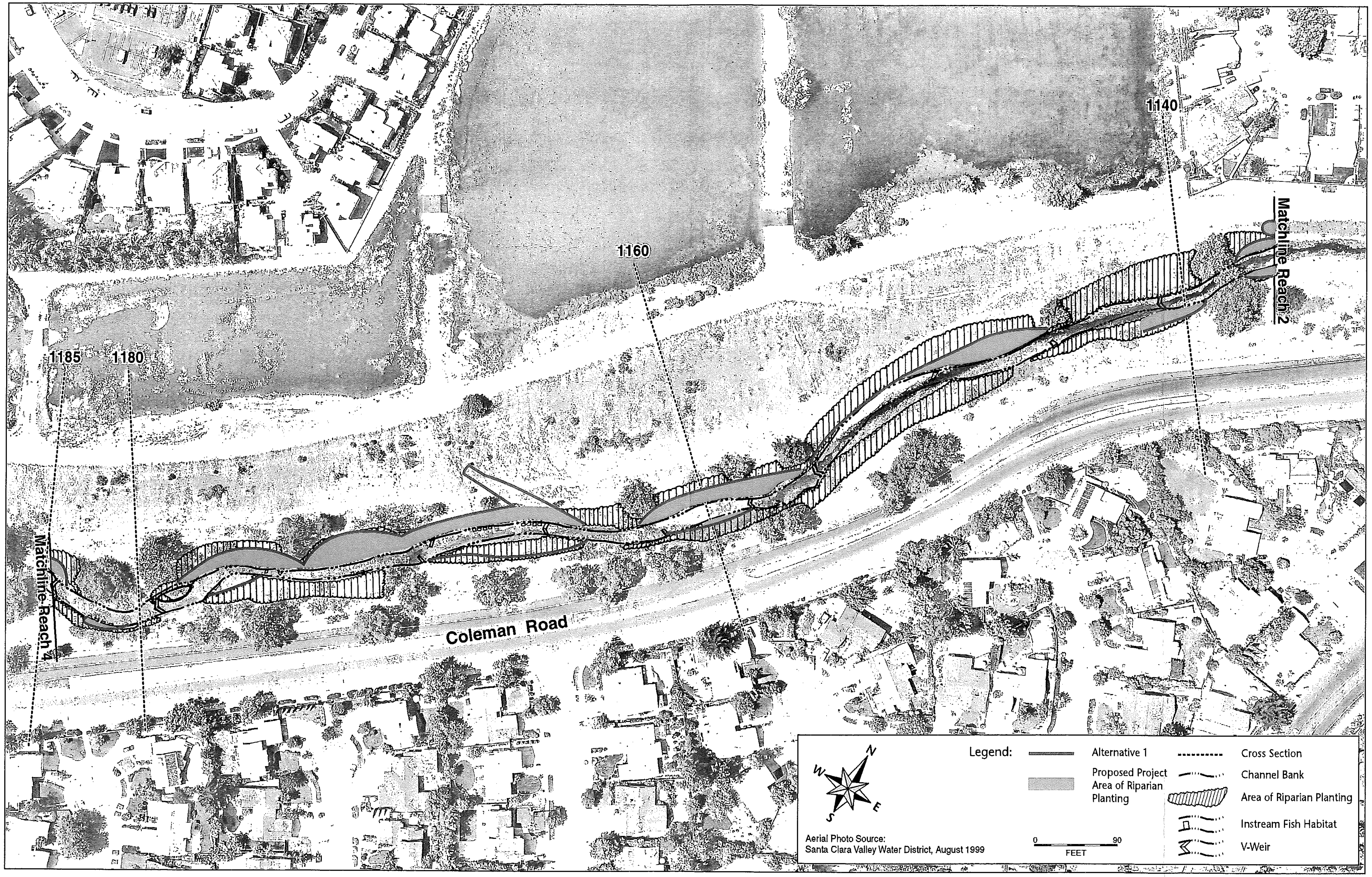


Figure 5-9
Alternative 2 - Reach 3

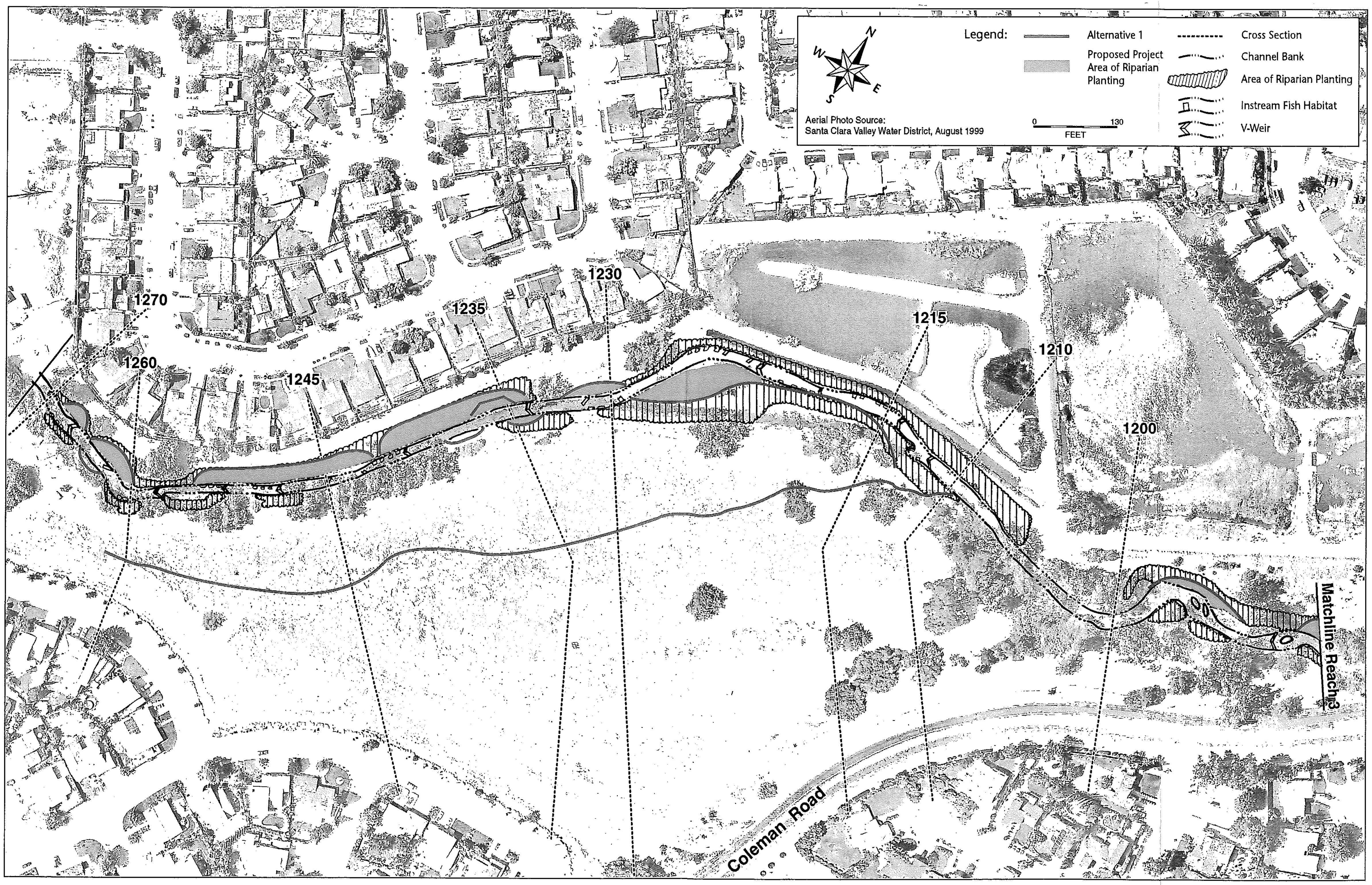
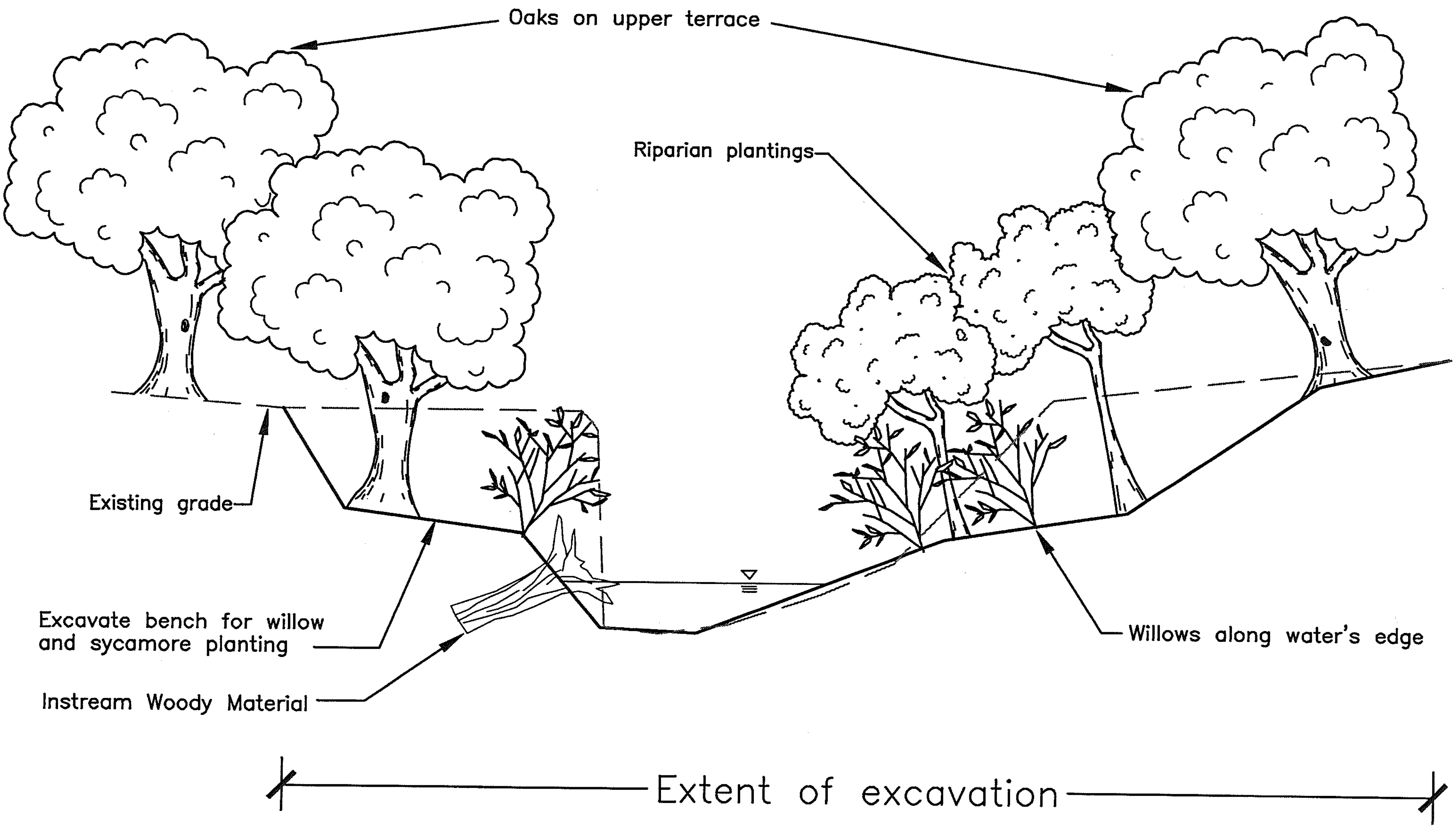


Figure 5-10
Alternative 2 - Reach 4



Jones & Stokes

Figure 5-11
Alternative 2 - Typical Cross Section

surfaces for planting along Coleman Road and to protect the maintenance road levee from further erosion.

Instream structures (e.g., rootwads and other IWM, stream barbs, boulders, and v-weirs) will be incorporated into the channel bed and banks to control existing erosion, narrow the low-flow channel, provide cover and instream habitat for fish, and improve hydraulic diversity while maintaining the low sinuosity of the existing planform. Rootwads, barbs, and similar features will also be used to stabilize the bench along Coleman Road and to provide instream cover for fish.

The planting program for Reach 1 will emphasize planting sycamores and other riparian vegetation on existing bar surfaces and existing and created floodplain surfaces to create a strip of riparian vegetation along the north channel bank, and to fill gaps in the existing riparian canopy. The bench at the toe of the slope along Coleman Road will also be planted with riparian species. Oak woodland species will be planted at relatively low elevations where soils are coarse and permeable and contain less moisture. Immediately upstream from the Almaden Expressway Bridge, planting areas will be tapered to ensure that the bridge opening is unobstructed, and existing access to the bridge will be maintained to facilitate maintenance activities.

5.1.2.2 Reach 2

The existing planform of the creek will generally be maintained in Reach 2. Minor modifications will be made to lower floodplains in most areas, except downstream from the Meridian Avenue Bridge, where more extensive excavation will expand the floodplain on the parcel owned by the City. This expansion will reduce the flow velocity in the main channel while preserving a band of willows along the south bank. An existing sycamore tree at the top of the bank will be removed to allow for the expansion of the floodplain. An existing oak in the same area may also be removed.

Instream structures will also be installed in Reach 2. IWM will be used to improve bank stability, to increase instream cover, and to increase channel complexity and hydraulic diversity in the low-flow channel. Bank stabilization structures will be used on the bend upstream from Meridian Avenue to protect the maintenance road and improve instream cover. Near the downstream end of Reach 2, bank stabilization measures will be installed at the toe of the bank adjacent to Coleman Road.

Planting in Reach 2 will focus on establishing riparian vegetation on the lower floodplain surfaces within the 15-foot zone adjacent to the low-flow channel. Immediately upstream and downstream from the Meridian Avenue Bridge, the planting areas will be tapered to ensure that the bridge opening is unobstructed. Sycamore woodland species will be planted on the north side of the creek immediately upstream from the bridge to ensure that the plantings do not impede floodflows.

5.1.2.3 Reach 3

Project features proposed for Reach 3 will focus on creating planting surfaces for riparian vegetation, and increasing hydraulic diversity in the channel. IWM will be added to stabilize the bed and banks, to increase cover, and to increase channel complexity and hydraulic diversity. Woody material will also be placed on the bar surfaces in Reach 3 to stabilize the bars and provide additional planting sites.

The planting program in this reach will focus on planting riparian vegetation within the 15-foot zone adjacent to the low-flow channel, and on sites created by the installation of bank structures and placement of IWM on the backs of bars. Oak woodland species will be planted on the higher surfaces to fill gaps between existing vegetation.

5.1.2.4 Reach 4

In the downstream segment of the reach, significant SRA cover vegetation already exists and fish habitat values are high. Under Alternative 2, only minor modifications will be made to the channel in this portion of Reach 4. Woody material will be placed in an existing erosion cusp to protect the maintenance road, shelter young riparian vegetation, and provide additional planting sites.

Downstream from Percolation Pond 1, which serves as a settling basin for the percolation pond system, approximately 350 feet of the existing maintenance road will be shifted to the north to create a wider bench adjacent to the channel. This shift will increase flood conveyance capacity and provide a buffer to protect the road from bank erosion.

In the area adjacent to Percolation Pond 1, the channel will be relocated north to reoccupy a historical channel alignment. Two existing sycamores may be affected by the channel alignment. Approximately 600 feet of new channel will be created. This realignment will require relocating the maintenance road approximately 10 feet to the north, and filling the existing channel to create a new floodplain. Percolation Pond 1 will not be modified. These actions will lengthen the channel and increase instream cover and channel complexity. The channel alignment will use existing mature trees to shade the new stream surface. Existing Phase 1 plantings affected by the channel realignment will be transplanted in appropriate areas.

In the upstream segment of Reach 4, the floodplain will be expanded. On the south side of the channel, a broad lowered floodplain surface will be graded along the stream at the edge of the Los Capitancillos Freshwater Wetland Mitigation Site. On the north side of the channel, the width of the maintenance road will be reduced to 25 feet to create a floodplain bench. In addition, some of the existing riprap along the north bank will be removed.

The planting program in Reach 4 will focus on planting riparian vegetation and oak woodland species on created surfaces. Along the south bank of the creek, existing riparian vegetation upstream will be preserved. Additional project features that will be implemented in Reach 4 include installing

IWM to provide planting sites on bar surfaces and installing rootwads and other structures to stabilize the outside banks of meander bends and to create instream cover.

5.1.2.5 Cost

The estimated cost of Alternative 2 is $6,819,010. A detailed breakdown of costs associated with this alternative is provided in Appendix D.

5.1.3 Alternative 3: Minimal Channel and Floodplain Modification Alternative

The Minimal Channel and Floodplain Modification Alternative (Alternative 3) would incorporate many of the restoration features specified for the proposed project. However, under Alternative 3, the amount of bank excavation would be substantially reduced and would focus only on key areas within the 15-foot zone adjacent to the low-flow channel. Only one channel planform shift would occur (Reach 4) under Alternative 3. Planting densities throughout the project site would be reduced to compensate for reduced flood conveyance capacity, and planting in Reach 4 would be limited to in-fill planting within existing stands of riparian vegetation. The number of bank and bed stabilization structures installed under Alternative 3 would be substantially increased to reduce the potential for channel incision and bank erosion. Implementation of this alternative would involve shifting approximately 300 linear feet of existing stream channel, excavating and removing approximately 11,500 cubic yards of material and importing 7,000 cubic yards of material to create suitable planting sites. In addition, approximately 1,285 linear feet bank protection features would be installed, and approximately 2.3 acres of riparian vegetation and 6,800 linear feet of SRA cover vegetation would be established under Alternative 3. Specific project features associated with this alternative are described below on a reach-specific basis. Plan view illustrations for each reach and a typical cross section is shown on Figures 5-12 through 5-16.

5.1.3.1 Reach 1

Under Alternative 3, the planting program for Reach 1 will emphasize planting sycamores and other riparian vegetation on existing floodplain and bar surfaces to create a strip of riparian vegetation along the north bank, and to fill gaps in the existing riparian canopy. The bench at the toe of the slope along Coleman Road will also be planted with riparian species. Oak woodland species will be planted at relatively low elevations where soils are coarse and permeable and contain less moisture. Immediately upstream from the Almaden Expressway Bridge, planting areas will be tapered to ensure that the bridge opening is unobstructed, and existing access to the bridge will be maintained to facilitate maintenance activities.

Instream structures (e.g., rootwads and other IWM, stream barbs, boulders, and v-weirs) will be incorporated into the channel bed and banks to control existing erosion, narrow the low-flow channel, provide cover and instream habitat for fish, and improve hydraulic diversity. Rootwads, barbs, and similar features will also be used to stabilize the bench along Coleman Road and to provide instream cover for fish.

5.1.3.2 Reach 2

The existing planform of the creek will be maintained in Reach 2 and only minor modifications will be made to lower floodplains in most areas. Instream structures will be installed to improve bank stability, to increase instream cover, and to increase channel complexity and hydraulic diversity in the low-flow channel. Bank stabilization structures will be used on the bend upstream from Meridian Avenue to protect the maintenance road and improve instream cover. Near the downstream end of Reach 2, bank stabilization measures will be installed at the toe of the bank adjacent to Coleman Road.

Planting in Reach 2 will focus on establishing riparian vegetation on the lower floodplain surfaces within the 15-foot zone adjacent to the low-flow channel. Immediately upstream and downstream from the Meridian Avenue Bridge, the planting areas will be tapered to ensure that the bridge opening is unobstructed. Sycamore woodland species will be planted on the north side of the creek immediately upstream from the bridge to ensure that the plantings do not impede floodflows.

5.1.3.3 Reach 3

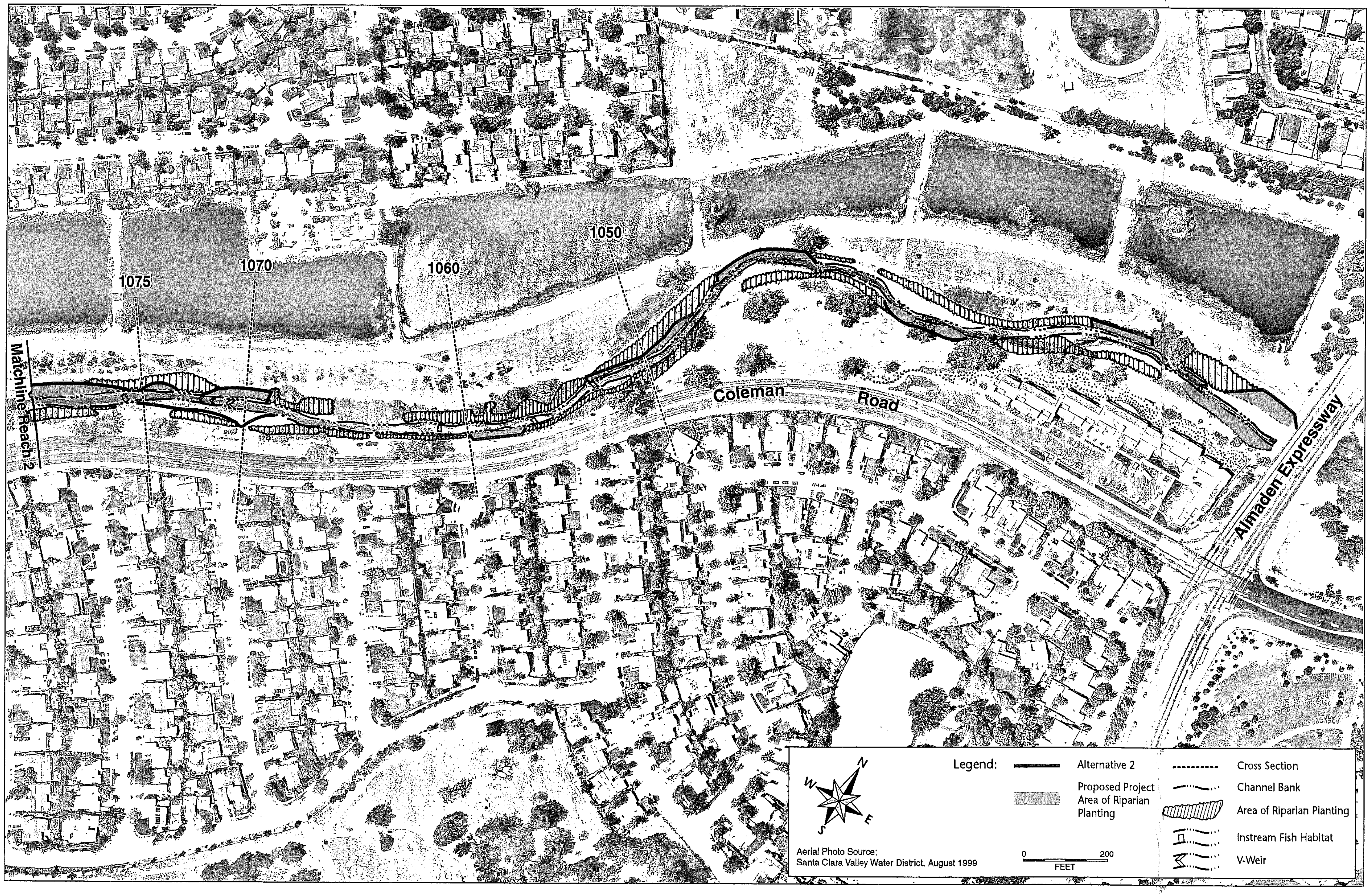
Project features proposed for Reach 3 will focus on modifying the existing floodplain in key areas to provide planting surfaces for riparian vegetation. IWM will be added to stabilize the bed and banks, to increase cover, and to increase channel complexity and hydraulic diversity. Woody material will also be placed on the bar surfaces in Reach 3 to stabilize the bars and provide additional planting sites.

The planting program in this reach will focus on planting riparian vegetation within the 15-foot zone adjacent to the low-flow channel, and on sites created by the installation of bank structures and placement of IWM on the backs of bars. Oak woodland species will be planted on the higher surfaces to fill gaps between existing vegetation.

5.1.3.4 Reach 4

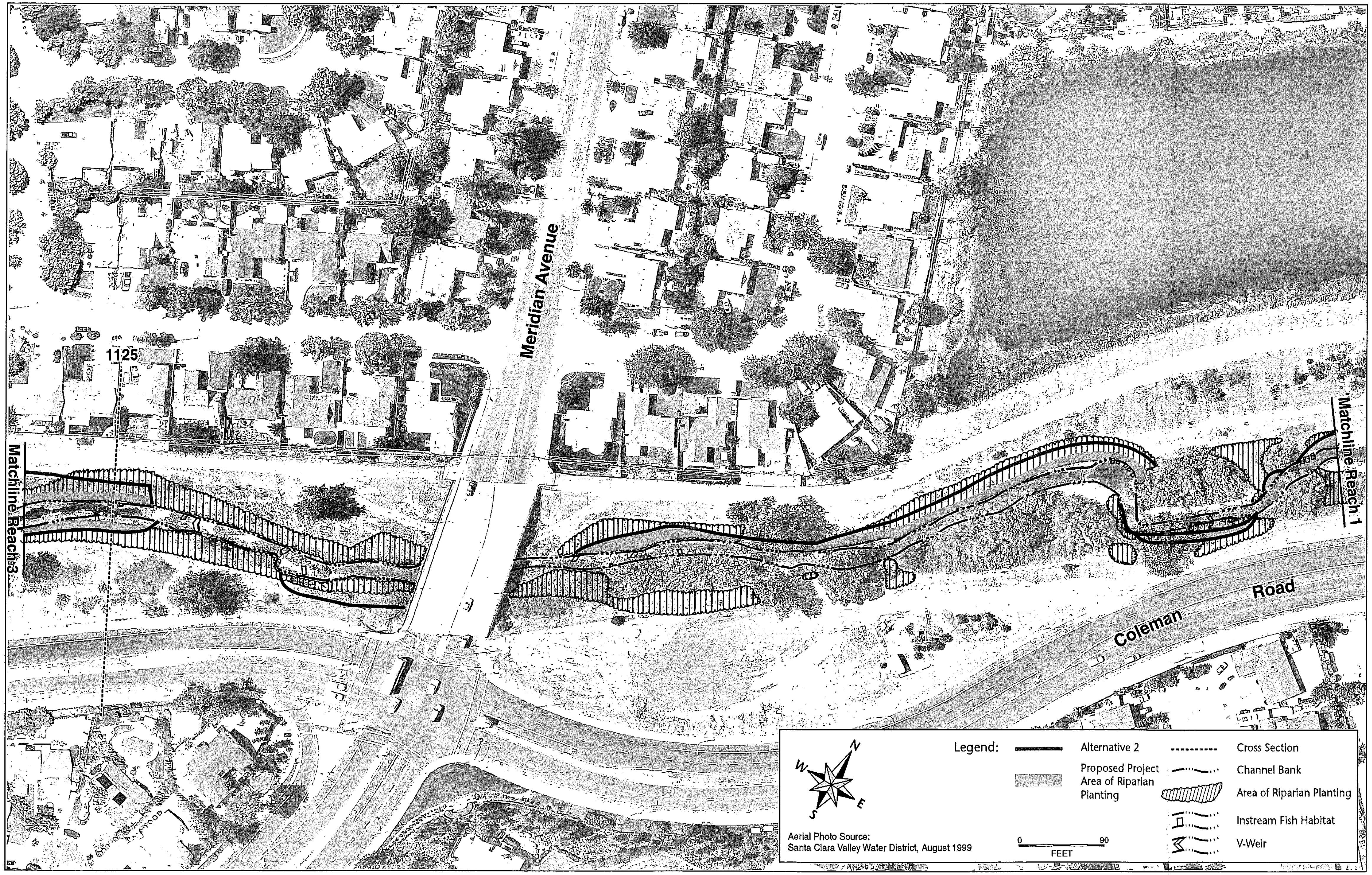
Under Alternative 3, only minor modifications will be made to the channel in the downstream segment of Reach 4. Woody material will be placed in an existing erosion cusp to protect the maintenance road, shelter young riparian vegetation, and provide additional planting sites.

The planting program in Reach 4 will focus on planting riparian vegetation and oak woodland species within existing stands of riparian vegetation. Along the south bank of the creek, existing riparian vegetation upstream will be preserved. Additional project features that will be implemented



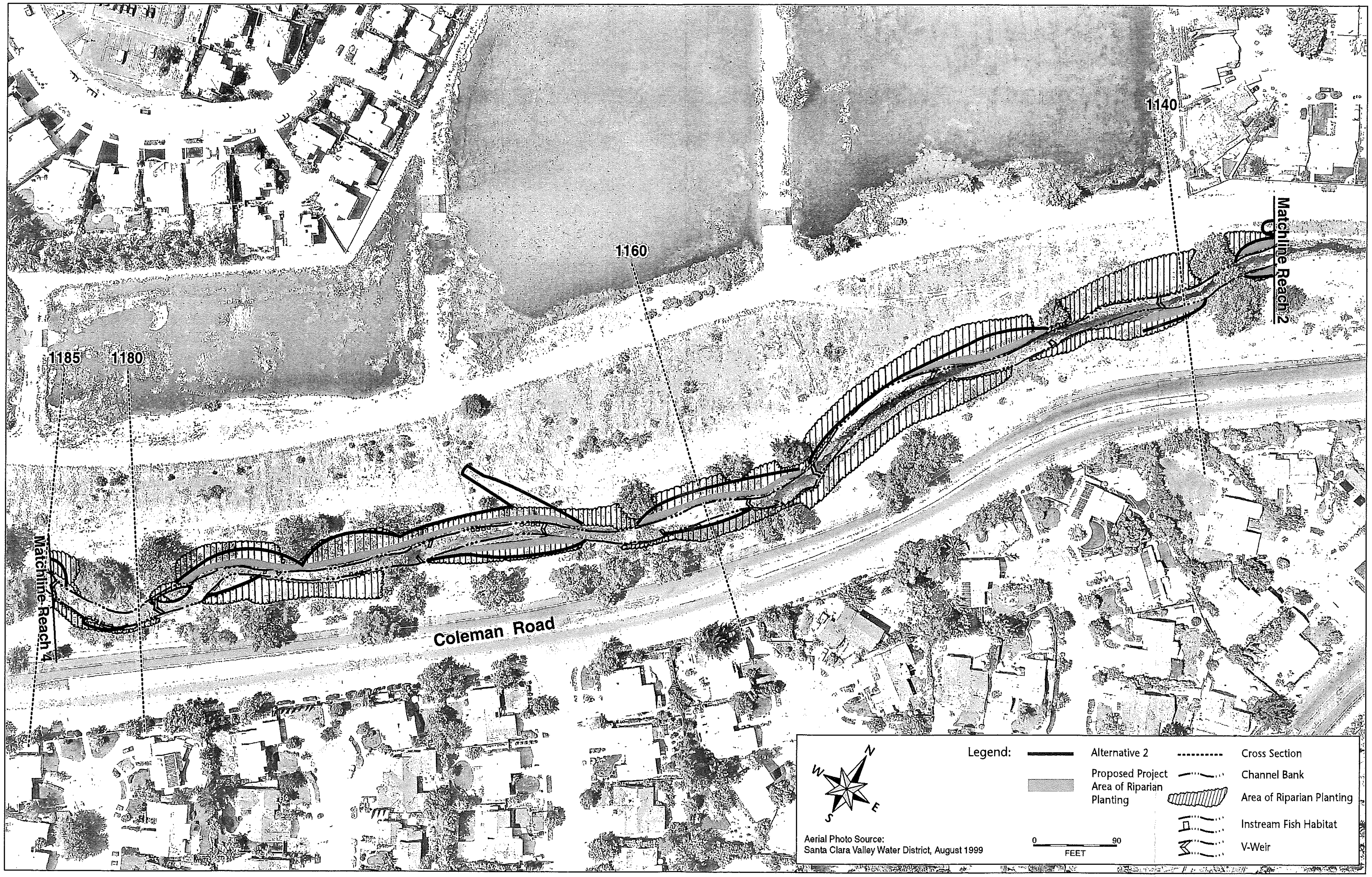
Aerial Photo Source:
Santa Clara Valley Water District, August 1999

Figure 5-12
Alternative 3 - Reach 1



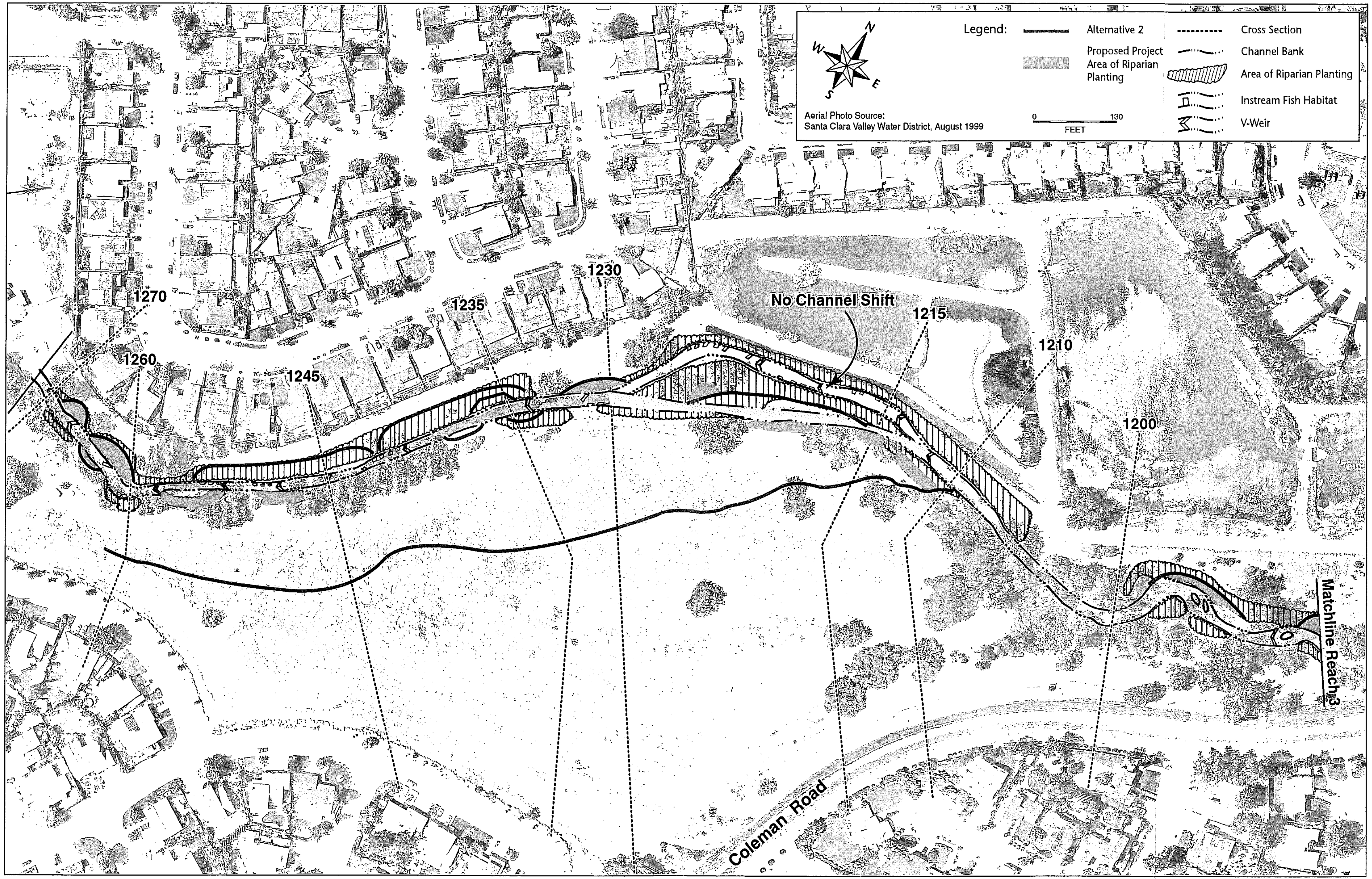
Aerial Photo Source:
Santa Clara Valley Water District, August 1999

Figure 5-13
Alternative 3 - Reach 2



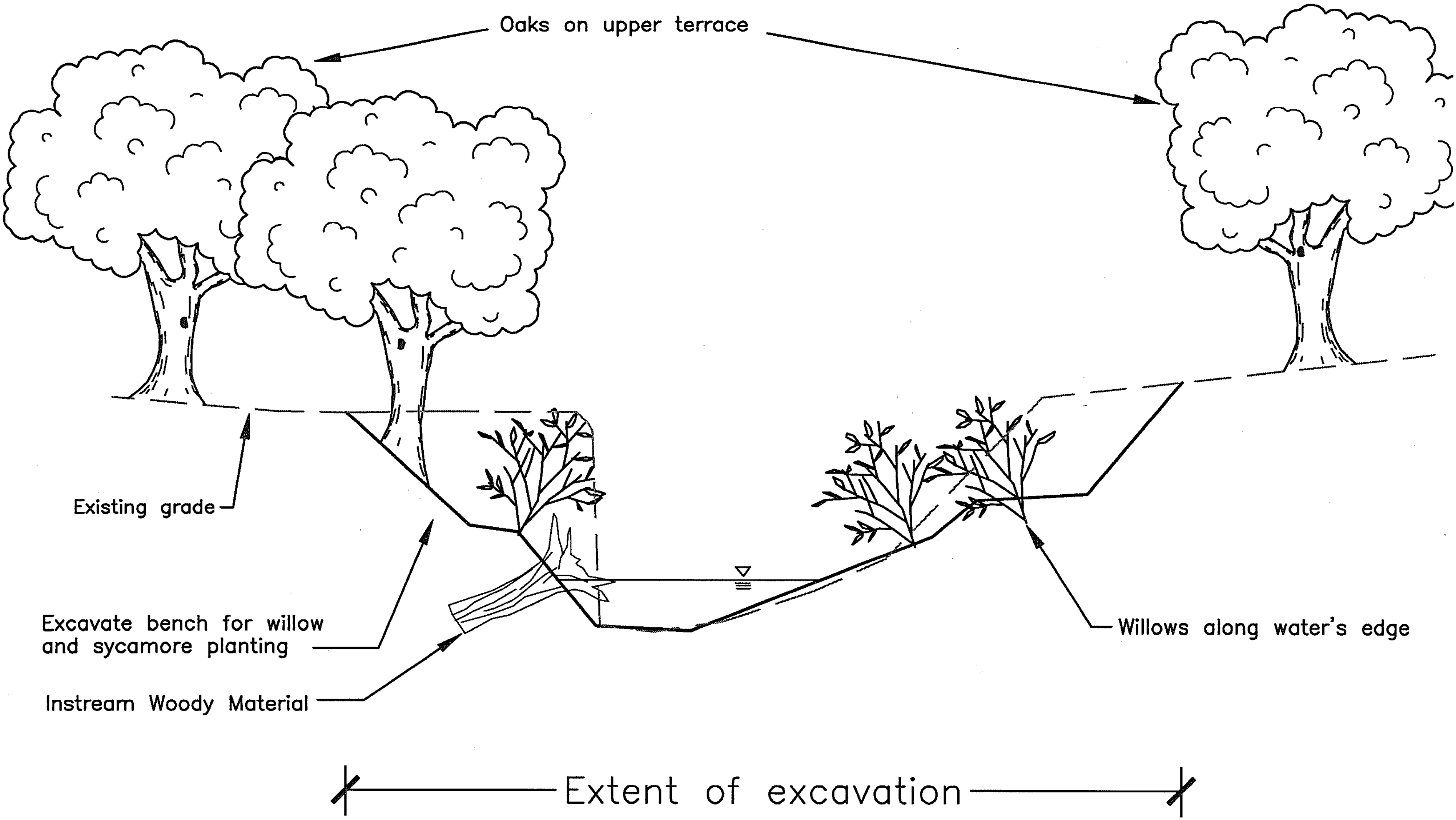
Aerial Photo Source:
Santa Clara Valley Water District, August 1999

Figure 5-14
Alternative 3 - Reach 3



Jones & Stokes

Figure 5-15
Alternative 3 - Reach 4



Jones & Stokes

Figure 5-16
Alternative 3 - Typical Cross Section

in Reach 4 include installing IWM to provide planting sites on bar surfaces and installing rootwads and other structures to stabilize the outside banks of meander bends and to create instream cover.

5.1.3.5 Cost

The estimated cost of Alternative 3 is $4,495,370. A detailed breakdown of costs associated with this alternative is provided in Appendix D.

5.1.4 Alternative 4: No-Project Alternative

The No-Project Alternative assumes "existing conditions" and evaluates the "likely future conditions" in the project area without implementation of the proposed project. Under the No-Project Alternative, no additional riparian and SRA cover habitat would be created and aquatic habitat would not be enhanced within the project area. Water temperatures and aquatic habitat would continue to be less than optimal for anadromous fish species.

5.2 EVALUATION OF ALTERNATIVES

Table 5-1 shows the extent to which the three alternatives meet the objectives developed for the Guadalupe Creek Restoration project and Table 5-2 provides a summary comparison of the activities proposed under each of the three project alternatives. Factors presented in Table 5-2 include: earthwork, planting, instream habitat features, estimated costs, and potential impacts on existing resources. The EIR/EIS presents a more detailed discussion of the potential impacts associated with the alternatives.

5.3 SELECTION OF THE RECOMMENDED PROJECT

Based on a comparison and evaluation of the benefits, estimated costs, and potential impacts associated with the 3 project alternatives, Alternative 1: Floodplain and Channel Modification has been selected as the "recommended project" for implementation by the District. Implementation of the Floodplain and Channel Modification Alternative would meet the proposed project's primary objective of restoring shaded riverine aquatic (SRA) cover vegetation and improving aquatic habitat for anadromous fish and would result in a substantial increase in biological resources in the project area. The net benefits to the environment associated with the proposed project, the establishment of 6 acres of riparian vegetation and 13,000 linear feet of SRA cover vegetation are much greater than those associated with the other alternatives. The proposed project also meets the secondary objectives of creating riparian habitat, enhancing aquatic habitat, and restoring natural ecological and physical processes while maintaining existing flood conveyance capacity and minimizing impacts on existing resources. Although implementation of the recommended project would involve a greater commitment of District resources than the other alternatives, the recommended project would provide substantially greater net benefits (i.e., linear feet and acreage of SRA cover and riparian vegetation) than the other alternatives. In addition, under the recommended project a significant amount of riparian vegetation that could be used to mitigate impacts associated with future District projects would be established.

The recommended project has also been identified as the environmentally superior/environmentally preferable alternative pursuant to the requirements of CEQA and NEPA. The environmentally superior/environmentally preferable alternative is the alternative that will result in the least damage to the biological and physical environment and the alternative that will protect, preserve, and enhance historic, cultural, and natural resources while accomplishing the project's objectives. In addition, features associated with the proposed project (e.g., extensive floodplain excavation) may improve existing mercury-related site conditions (e.g., sediment transport, methylation, bioaccumulation) and result in a greater net benefit to aquatic habitat and water quality than the other alternatives.

5.4 BEST MANAGEMENT PRACTICES

Best Management practices (BMPs) are methods, measures, or practices that avoid, reduce or minimize a project's effects on various resources. BMPs include, but are not limited to, structural and nonstructural controls and operations and maintenance procedures. They can be applied before, during, and after activities to reduce or eliminate environmental effects. BMPs are part of the project design and/or constitute routine District procedures; by contrast, mitigation measures are developed separate from the project design to address specific environmental impacts.

The following sections list and describe BMPs that will be incorporated into the recommended project to reduce or eliminate environmental effects. In addition to the BMPs described here, project implementation and maintenance will adhere to the procedures listed in the District's most current BMP plan (Santa Clara Valley Water District 1999). Not all of the BMPs listed below are for potentially significant effects. Many BMPs are included to reduce less-than-significant impacts to even lower levels as part of the District's commitment to environmental stewardship.

5.4.1 Vegetation Protection Measures

Measures to protect riparian vegetation during construction will be implemented under the BMPs included in the recommended project's construction drawings and specifications. Prior to project construction, plastic barrier fencing will be erected or other similar measures will be implemented along the boundaries of the construction area in order to protect adjacent vegetation. If any protected trees are damaged during construction, they will be trimmed under the direction of a qualified arborist to minimize the risk of disease. If any trees not approved for removal are damaged beyond recovery during construction, they will be replaced either with trees of the same species or with trees of another approved species listed in the project drawings and specifications.

Table 5-1. Extent to Which the Alternatives Meet the Project Objectives

	Project Alternatives		
	Channel and Floodplain Modification (Proposed Project)	Reduced Channel and Floodplain Modification (Alternative 1)	Minimal Channel and Floodplain Modification (Alternative 2)
Primary Objectives			
Restore shaded riverine aquatic (SRA) cover vegetation and improve aquatic habitat for anadromous fish in lower Guadalupe Creek, between Almaden Expressway and Masson Dam	+++	++	+
Secondary Objectives			
Create 5,915 linear feet of SRA cover vegetation that may serve as off-site mitigation for impacts associated with the Guadalupe River Flood Protection Project	+++	++	+
Create riparian habitat, including SRA cover vegetation, that may provide mitigation credit for future District projects	++	+	+
Enhance or restore habitat for special-status fish and wildlife species, as consistent with other project objectives	+	+	+
Restore physical processes and ecological functions along the project reach of Guadalupe Creek	++	+	+
Protect existing infrastructure in the project area	++	++	+
Maintain existing flood conveyance capacity	+	+	+
Minimize impacts on existing resources	+	+	++
Improve recharge of groundwater aquifers	0	0	0
Minimize long-term operations and maintenance requirements	++	+	+
Minimize impacts on existing water management operations	+	+	++
Design project so that it does not preclude future recreation uses that are compatible with other project objectives	+	+	+
Strive to meet regional planning objectives as outlined in relevant regional planning documents	+	+	+

Notes:

0 = does not meet objective - neutral or minor change from existing conditions.

+ = meets objective

++ = meets objective and provides moderate additional benefits

+++ = meets objective and provides substantial additional benefits.

Table 5-2. Comparison of Features Associated with the Project Alternatives

	Project Alternatives		
	Channel and Floodplain Modification (Proposed Project)	Reduced Channel and Floodplain Modification (Alternative 1)	Minimal Channel and Floodplain Modification (Alternative 2)
Earthwork			
Channel realignment	2,500 linear feet	1,200 linear feet	300 linear feet
Soil importation	13,000 cubic yards	8,500 cubic yards	7,000 cubic yards
Soil removal and disposal	42,000 cubic yards	31,000 cubic yards	11,500 cubic yards
Fisheries Habitat Improvements			
Rootwads and bar IWM	260 pieces	220 pieces	220 pieces
Stream barbs and buried groins	36 pieces	35 pieces	40 pieces
V-weirs and cross weirs	25 pieces	25 pieces	28 pieces
Bank Protection			
Bank Protection	725 linear feet	1,095 linear feet	1,285 linear feet
Total Planting			
Riparian scrub and forest	3.2 acres		
Sycamore alluvial woodland	3.2 acres	4 acres	2.3 acres
SRA cover vegetation	13,000 linear feet	9,500 linear feet	6,800 linear feet
Potential Impacts			
Phase 1 plantings			
Sycamorre alluvial woodland			
Net Planting			
Sycamorre alluvial woodland			
SRA cover vegetation			
Order of Magnitude Costs	*[forthcoming]*	*[forthcoming]*	*[forthcoming]*

5.4.2 Storm Water Pollution Prevention Plan

The recommended project is subject to the stormwater quality regulations of the NPDES, described in Section 402 of the federal CWA (see related discussion in Chapter 2. In California, the NPDES program requires that any construction activity disturbing an area of 5 acres or more comply with the statewide General Permit, as administered by the SWRCB. The General Permit requires the elimination or minimization of stormwater and non-stormwater discharges from construction sites and the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) for the project. The SWPPP must be retained at the construction site. Implementation of the SWPPP will be monitored during project construction. Upon completion of project construction, SWRCB will be notified that all state and local requirements have been met.

The primary elements of a SWPPP include:

- a description of site characteristics, including runoff and streamflow characteristics and soil erosion hazard;
- a description of proposed construction procedures;
- a description of measures that will be implemented for erosion and sediment control (discussed in more detail below);
- a description of measures that will be implemented to prevent toxic materials spills (spill prevention and response plan, discussed in more detail below); and
- a description of proposed construction-site housekeeping practices.

In addition to these primary elements, the SWPPP must also specify that the extent of soil and vegetation disturbance will be minimized and that the area of soil disturbed at any given time will be minimized.

The following sections describe the required components of the erosion and sediment control measures and the spill prevention and response plan included in the SWPPP.

5.4.2.1 Erosion and Sediment Control Measures

Because increased sediment input to Guadalupe Creek may have an adverse impact on aquatic species and their habitat, measures to control the recommended project's contribution to erosion and movement of sediment into the creek will be implemented. These may include both vegetative and structural measures as well as construction-site housekeeping practices. The contractor selected for project construction will:

- conduct construction activities during the dry season;

- conduct all construction work in accordance with site-specific construction plans that minimize the potential for increased sediment inputs to the creek;

- divert concentrated runoff away from channel banks;

- minimize vegetation removal;

- identify with construction fencing all areas that require clearing, grading, revegetation, or recontouring and minimize the extent of areas to be cleared, graded, recontoured, or otherwise disturbed;

- grade and stabilize spoils sites to minimize erosion and sediment input to the creek and generation of airborne particulate matter (PM10) (see discussions under *Soil Management* and *Measures to Implement BAAQMD's Feasible Control Measures for PM10 Emissions from Soil Removal Activities* below);

- implement erosion control measures as appropriate to prevent sediment from entering the creek channel or other watercourses to the extent feasible, including the use of silt fencing or fiber rolls to trap sediments and erosion control blankets on channel banks;

- mulch disturbed areas as appropriate and plant with appropriate species as soon as practicable after disturbance; and

- avoid operating equipment in flowing water by using temporary cofferdams or other suitable structures to divert flow around the channel and bank construction area.

5.4.2.2 Spill Prevention and Response Plan

As part of the project SWPPP, the contractor selected for the recommended project will prepare a spill prevention and response plan that regulates the use of hazardous and toxic materials, such as the petroleum-based fuels and lubricants for construction equipment. The District will oversee implementation of the spill prevention and response plan. Elements of the plan will ensure that:

- workers are trained to avoid and manage spills;

- construction and maintenance materials are prevented from entering the creek;

- all spills are cleaned up immediately and appropriate agencies are notified of any spills and of the cleanup procedures employed;

- staging and storage areas for equipment, materials, fuels, lubricants, solvents, and other possible contaminants are located at least 100 feet away from the creek;

- vehicles are removed from the creek's normal high-water area before refueling and lubricating;
- vehicles are immediately removed from work areas if they are leaking; and
- equipment is not operated in flowing water (suitable temporary structures are installed to divert water around in-channel work areas).

5.4.3 Soil Management Measures

Soil and sediment spoils excavated during project construction will be temporarily stockpiled onsite and analyzed in accordance with standard protocols and tests used to ensure that potentially contaminated materials are appropriately disposed of at landfills. Contaminated spoils will then be hauled offsite for disposal. As discussed in Chapter 3, the primary concern in the project area is soil and sediment with elevated mercury concentrations. All Soil Management Measures will be submitted to the RWCQB and implemented upon approval and under oversight from the RWQCB. The following measures will be implemented to ensure safe handling and appropriate disposal of spoils.

- *Sampling of Excavated Sediments and Soils.* Materials grubbed, scrapped, and excavated from the channel bed and banks shall be randomly sampled for total mercury and methyl mercury concentrations, as well as other toxic substances such as benzene and lead, at a rate of one sample for every 2,500 cubic yards of material removed. A minimum of two samples shall be taken for any increment of material less than 2,500 cubic yards.
- *Removal of Excavated Materials.* Excavated material that is found to contain in excess of 20 milligrams per kilogram (mg/kg) mercury will be removed from the project area and properly disposed of in a Class I landfill. This material will be handled according to standard hazardous materials protocols.
- *Reuse of Excavated Materials.* Soils and sediments excavated onsite with mercury concentrations less than 19 mg/kg will be reused onsite in fill areas located outside the active streamchannel (approximately the 2-year flood recurrence level). Excavated material with mercury concentrations less than 1 mg/kg will be reused onsite in fill areas located within the active streamchannel.

Implementation of the Soil Management Measures, in conjunction with the Erosion and Sediment Control measures, will ensure that all materials excavated from the site that contain less than 19mg/kg total mercury will be reused on site in a benefical way. In addition, all materials excavated that contain more than 19mg/kg total mercury will be disposed of at a properly licensed facility. These measures will ensure that material contaminated with mercury is not eventually transported beck into the Guadalupe River watershed or into San Francisco Bay.

5.4.4 Construction Period Limits

To reduce the likelihood of adverse impacts on rearing juvenile steelhead and chinook salmon and on adult fish migrating to upstream spawning areas, in-channel construction, including both streambank and channel bed construction, will be limited to the summer low-precipitation period (April 15–October 15), with the condition that construction requiring stream dewatering, stream crossings, or instream work may not commence before May 1. Furthermore, work will be permitted to commence on May 1 only if the stream monitoring criteria have been satisfied by that date. Stream monitoring criteria that must be satisfied will include a determination that average daily water temperatures have exceeded 68 °F for at least 5 consecutive days and that outmigrating salmonids are absent. Determination of the absence of juvenile chinook salmon and steelhead in May will be based on ongoing downstream migrant trapping observations during the previous 14 days. If stream monitoring criteria are not met, in-channel work and dewatering will not be allowed to commence until June 1. If necessary, upstream passage for chinook salmon will be provided through or around construction sites from September 1 through October 15. The determination of the need to provide passage will be based on the occurrence of more than 25 adult chinook salmon, on flow conditions, and on a cooperative assessment of passage needs by the District, NMFS, and DFG. Construction outside the summer low-precipitation period will require previous approval from DFG and NMFS.

5.4.5 Construction-Area Fish Management Measures

During project construction, streamflow will be diverted at Masson Dam into the Los Capitancillos percolation pond system. Diversion activities will follow the guidelines listed below.

Flow will be incrementally diverted from the creek at the upstream boundary of the project area. Diversion will increase progressively over a 4-hour period, by the following increments: 50%, 75%, 90%, 95%, and 100%. This incremental reduction in flow will allow fish to move downstream.

- All native aquatic vertebrates and larger invertebrates will be moved by a qualified fisheries biologist prior to dewatering.

- Fish will be removed from pools remaining after flow is diverted from the project reaches of the creek. The District, NMFS, and DFG will cooperate to develop a method and protocol for capturing and relocation of stranded fish. Qualified fisheries biologists will transport captured fish immediately to a flowing river segment. Fisheries biologists will contact NMFS immediately if any steelhead or chinook salmon are found dead or injured, except for spawned-out adult chinook salmon.

- If a fisheries biologist determines that juvenile chinook salmon and steelhead are present during June and that construction activities may impede their downstream passage, a fish trap will be placed above the upstream barrier and operated by a fisheries biologist. The determination that juvenile chinook salmon and steelhead are present during June will be based on their occurrence during any of the previous 14 days in ongoing downstream migrant trapping. The trap at the construction site will be removed if juvenile chinook salmon and steelhead are not captured at the construction site or by ongoing downstream migrant trapping during 14 consecutive days. In order to maintain fish in good condition, all migrating steelhead and juvenile chinook salmon will be removed from the trap every 24 hours, or at another appropriate time interval, as determined by a qualified fisheries biologist. Captured fish will be counted, measured, and transported immediately to a flowing creek segment that allows downstream migration. Additional details of downstream migrant trapping, including specific reporting requirements, will be coordinated with NMFS.

- Adult chinook salmon may arrive at the downstream end of the project area before the end of construction on October 15. If necessary, upstream passage for chinook salmon will be provided through or around the construction site from September 1 through October 15. The determination of the need to provide passage will be based on the occurrence of more than 25 adult chinook salmon, on flow conditions, and on a cooperative assessment of passage needs by the District, NMFS, and DFG. The determination that adult chinook salmon are present will be based on trapping at an appropriate downstream location or on an appropriate alternative method developed cooperatively by the District, NMFS, and DFG.

5.4.6 Measures to Comply with Migratory Bird Treaty Act

The project site is located in and adjacent to habitat that may support nesting birds protected under the federal Migratory Bird Treaty Act (MBTA). Barrier fencing erected as part of the project's vegetation protection measures will also protect nesting vegetation located outside the boundaries of the construction area. If any construction occurs during the February 16–July 31 migratory bird nesting season, a qualified biologist will survey the construction area for eggs and young migratory birds immediately prior to construction. If eggs or migratory birds are found inside the construction area boundaries, the District will develop appropriate protective measures and will inform DFG of its actions.

5.4.7 Measures to Implement Bay Area Air Quality Management District's Feasible Control Measures for PM10 Emissions from Soil Removal Activities

The following list of measures for controlling PM10 emissions will be implemented during project construction. These measures are contained in the Bay Area Air Quality Management

District's (BAAQMD's) Feasible Control Measures for PM10 Emissions from Soil Removal Activities (Bay Area Air Quality Management District 1996).

- All active construction sites will be watered at least twice daily. Watering should be conducted frequently enough to prevent the generation of visible dust emissions.
- All trucks hauling soil, sand, and other loose materials will be covered or will be required to maintain at least 2 feet of freeboard.
- All unpaved access roads, parking areas, and staging areas will be watered three times daily, or will be stabilized using nontoxic soil stabilizers.
- Apply (non-toxic) soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more).
- Enclose, cover, water twice daily, or apply (non-toxic) soil stabilizers to exposed stockpiles.
- Streets will be swept daily with water sweepers if visible soil material is carried onto adjacent public streets.
- Suspend excavation and grading activity when winds (instantaneous gusts) exceed 25 mph.
- Traffic speeds on unpaved roads will be limited to 15 mph.

5.4.8 Measures to Address Traffic-Related Effects

The District will require the selected contractor to prepare and implement a traffic safety plan. This plan will address appropriate vehicle size and speed, travel routes, detour and closure plans, flagperson requirements, locations of turnouts to be constructed, coordination with law enforcement and fire control agencies, coordination with Caltrans personnel (for work affecting state road rights-of-way), emergency access to ensure public safety, and need for traffic and speed-limit signs. Additionally, the contractor will limit transportation of imported and exported materials to non-peak traffic commute hours (9:00 a.m. to 4:00 p.m., Monday through Friday).

5.4.9 Measures to Address Cultural Resources

An archaeologist meeting the Secretary of the Interior's Standards for Professional Archaeologists will be on call during ground-disturbing activities. If a prehistoric archaeological site is discovered, criteria of the NRHP will be used to evaluate the site for significance. A Native

American monitor will be present during the evaluation of the site's significance. Work in the area will be stopped until the site is evaluated and appropriately treated. If prehistoric or historic archaeological sites that appear eligible for NRHP are discovered, procedures stipulated under implementing regulations for the NHPA (36 CFR 800) will be followed. These procedures include consulting with SHPO to confirm eligibility of the site(s) for the National Register and development of a Memorandum of Agreement that specifies treatment for the site(s). Treatment may include data recovery, site avoidance, or capping the site to avoid further impacts.

If human remains of Native American origin are discovered during project construction, relevant procedures identified in the California State public health and safety codes will be followed. Public Resources Code Section 7050.5 requires that construction or excavation be stopped in the vicinity of discovered human remains until the county coroner can determine whether the remains are those of a Native American. If the remains are determined to be those of a Native American, the coroner must contact the California Native American Heritage Commission. If human remains are discovered, there shall be no further excavation or disturbance of the site or any nearby area reasonably suspected to overlie adjacent human remains until:

1. The Santa Clara County Coroner has been informed and has determined that no investigation of the cause of death is required; and

2. if the remains are of Native American origin:

    a. the descendants of the deceased Native American(s) have made a recommendation to the landowner or the person responsible for the excavation work for means of treating or disposing of, with appropriate dignity, the human remains and any associated grave goods as provided in Public Resources Code Section 5097.98; or

    b. the Native American Heritage Commission was unable to identify a descendant or the descendant failed to make a recommendation within 24 hours after being notified by the commission.

According to California Health and Safety Code, six or more burials at one location constitute a cemetery (Section 8100), and disturbance of Native American cemeteries is a felony (Section 7052).

5.4.10 Measures to Address Noise-Related Effects

The contractor selected for the project will be required to comply with all relevant provisions of the City noise ordinance; noise-reducing construction practices will be employed. For example, all construction equipment will be required to have sound-control devices at least as effective as those originally provided by the manufacturer, and no equipment will be permitted to have an unmuffled exhaust. In general, construction will take place between 7:00 a.m. and 5:00 p.m., Monday through Friday, and no construction activities will occur on holidays or weekends.

Extending weekday hours and working weekends may be necessary for short periods to complete some aspects of the project; however, these periods will be limited. In addition, the contractor will implement appropriate additional noise mitigation measures, including, but not limited to, the following: changing the location of stationary construction equipment, shutting off idling equipment, and notifying adjacent residents in advance of construction work.

- assessing the ability of the project to meet the project objectives;
- identifying and analyzing potential effects to existing biological resources, hydrology, hydraulic capacity, and adjacent infrastructure; and
- determining quantity take-offs, developing cost estimates, and preparing the contract documents.

The preferred alternative also provides a format for soliciting additional input and direction from the District and key stakeholders before developing the detailed design.

Chapter 6. Maintenance Program

The proposed project will require maintenance activities associated with habitat restoration, as well as a monitoring and adaptive management program established by the Downtown Project MMP. The contractor selected by the District will be responsible for maintenance and monitoring the plantings and maintaining the restoration sites during the 3-year establishment period. The contractor will perform the following general maintenance activities: weed control, irrigation system maintenance, and planting replacement. Specific methods and schedules for maintenance activities will be included in the final contract documents prepared for the proposed project.

6.1 MONTHLY MAINTENANCE

During the first 3 years after construction, monthly maintenance operations will include; weed control, irrigation system operation, supplemental watering, replacement planting, and reseeding. Plant establishment will begin on the first day after acceptance of the plant installation.

Maintenance operations will include checking each plant location a minimum of once every 2 weeks during times when the irrigation system is operating and a minimum of once per month during times when the irrigation system is not operating. During these maintenance operations, the Contractor will examine conditions of plants, plant protection cages, weed growth, and stability of soil berm, and examine soil moisture around each plant to ensure that the irrigation system is providing adequate moisture to each plant during the irrigation season.

At the end of the 3 years maintenance period, the District will inspect the project site to evaluate the acceptability of the seeding, installation, and plant establishment practices.

In the event that plants are lost or severely damaged as a result of floodwaters flowing from the creek into the planting area, the Contractor will be responsible for replacing up to 10% of the original number of plants. If any additional plants are lost or severely damaged or if loss of or damage to the irrigation system occurs solely due to flooding, the District may choose to supply replacement plants and may request the Contractor to install the plants or replace or repair the irrigation system.

6.2 MATERIALS AND PLACEMENT

Plant protection cages and soil berms will be repaired and replaced as necessary to protect plants and assist in irrigation. Plant protection cages will be removed or the tops of the plant protection cages will be opened if the growth of any plant is being restricted.

As part of maintenance activities, the Contractor will identify the most vigorous oak seedling at the end of 6 months after planting of acorns. All other oak seedlings surviving within the same plant basin will be removed by clipping off the leaders at the ground surface.

6.3 WEED CONTROL

Weed control will consist of maintaining all planting basins or an area 4 feet in diameter around each plant free of weeds. Weed control will be required in the seeded areas. Weed control in the cover crop area will be performed only using hand-pulling or herbicide spot treatment methods.

Weeds that grow within the planting basins or an area 4 feet in diameter around each plant, including the area within the plant protection cages, will be removed before reaching 4 inches in height or before covering 30% of the planting basin. In addition, mandatory weeding of all planting basins will occur three times during each of the first 3 years of maintenance.

Weed removal inside the plant protection cages will be done by hand-pulling. Weed removal outside the plant protection cages will be done by hand-pulling, mechanically (cutting at or below ground level), or by using herbicides and surfactants approved for use in floodplain areas. Weed removal will cause minimal disruption to the root systems of the installed plants and basins.

Herbicide will be applied according to manufacturer's specifications and without herbicide drift. Personnel performing weed control will be trained to identify species installed and will remove only those plants within the planting basins that were not specifically planted. Wherever possible, desired native plant volunteers will be retained.

6.4 IRRIGATION OPERATION

The Contractor will operate and maintain the irrigation system in a fully operational condition. The Contractor will be responsible for replacing or repairing any part of the irrigation system damaged as a result of improper maintenance activities or installation, normal wear and tear, defective materials, vandalism, or acts of nature (e.g., wildfire).

The Contractor bears full responsibility for watering plants in a manner that will maintain plant health and vigor and promote plant establishment and growth. The irrigation system will be operated, at a minimum, for the first two growing seasons.

The length and frequency of the irrigation cycles during the second and third growing seasons depend on the health and vigor of the plant material. The beginning and shutdown dates for the irrigation schedule depend on the weather. If the majority of the plant material appears to be stressed and in danger of perishing, the Contractor will consult the District to determine the frequency and duration of additional waterings. The Contractor will be responsible for supplemental watering of the plant materials, if watering is required when the irrigation system is not operational.

Irrigation maintenance will include examining the irrigation system once every 2 weeks during the irrigation season, testing each valve location to ensure that the controller is operational, and checking each bubbler location for leaks or blocked lines. At the end of each irrigation season, the Contractor will winterize the system by turning off the controller, closing the shut off valve at the water service point, and draining water from all above grade irrigation pipes.

6.5 REPLACEMENT PLANTING

Annual inspections of the site will be scheduled for 1 day each year to review plant material establishment and to determine mortality rates for plants. For each of the first 3 years of the maintenance, the allowable mortality rate will be 10% of the original number of plants. Plant losses in excess of 10% for each of the first 3-years will be replaced in the fall of each of the first 3 years of the maintenance.

Any dead plants in excess of the allowed mortality rates and identified at the annual inspection will be replaced by Contractor. In anticipation of procuring required replacement plant materials, an early season site inspection will be conducted to estimate plant mortality and required replacement plant quantities. Specified plants typically will be replaced with plants of identical species and original planting size unless the District determines that substitutions of another species or size will be made. Plants of larger size than those originally planted will not be required. Recommendations for species substitutions based on documented survivorship records for plants growing at the project site may be submitted by the Contractor in writing to the District for consideration at time of inspection.

All plant locations are limited to a maximum of two replacement plantings. The Contractor will remove dead plants before installing replacement plants. Replacement plants will be from propagules collected in the Guadalupe River watershed. The District may assist the Contractor in finding sources for acceptable replacement plants. Upon the approval of the Engineer, the Contractor may be allowed to use cuttings or transplants for replacement plantings if suitable stock is unavailable.

6.6 RESEEDING

The Contractor will reseed areas larger than 400 square feet that have less than 15% cover by target species with a modified seed mix to be approved by the District. Fertilizer will not be applied to seeded areas.

6.7 PLANT ESTABLISHMENT FORMS

Throughout the Maintenance Period, the Contractor will be responsible for daily record keeping of the plant establishment activities, including; irrigation, weed control, and plant mortality. The Contractor will compile all data recorded during the plant establishment activities. At the end of each month during the first 3 years of maintenance, the Contractor will compile the data collected and activities and observations noted for the month (one form for each month) for submittal to the District.

6.8 MONITORING

The Downtown Project MMP requires that the District monitor a number of specific indicators and assess the proposed project relative to a series of measurable performance objectives. Indicators that will be monitored during the 3-year postconstruction monitoring period include:

- survival of planted trees and shrubs;
- health and vigor of planted trees, shrubs, and seeds;
- natural recruitment of native species;
- vegetative cover;
- non-native species cover;
- water temperature; and
- anadromous fish passage and habitat quality.

Chapter 7. Project Cost, Funding, and Schedule

7.1 COST

The estimated project cost for the Guadalupe Creek Restoration Project is $8.5 million. There are no anticipated Right-of-Way acquisition costs. Estimated quantities and order-of-magnitude costs for the recommended project are provided in Table 7-1.

7.2 FUNDING

The recommended project would be funded with existing District revenues on reserve. The Corps, Sacramento District would fund an amount up to $5,000,000 under Section 215 of Public Law 90-483 agreement.

7.3 SCHEDULE

Advertising for bids is expected to begin in April 2000. Contract award is anticipated in early June 2001. Construction is scheduled to begin in June 2001 with an expected completion date of December 2001.

Table 7-1. Construction Cost Estimate for the Recommended Project

Item No.	Description of Bid Item	Approximate Quantity	Unit	Unit Price	Total
1	Storm Water Pollution Prevention Plan	1	Lump Sum	$50,000.00	$50,000
2	Mobilization /Demobilization	1	Lump Sum	$130,000.00	$130,000
3	Preservation Fencing	20,000	Linear Foot	$5.00	$100,000
4	Individual Plant Removal	1	Lump Sum	$30,000.00	$30,000
5	Cluster Plant Removal	91,000	Square Foot	$0.50	$45,500
6	Existing Tree Excavation for Transplanting	152	Each	$850.00	$129,200
7	Existing Tree Excavation for Reuse as Instream Woody Material	2	Each	$1,000.00	$2,000
8	Asphaltic Concrete Removal	1	Lump Sum	$3,000.00	$3,000
9	Existing Concrete Slope Protection Removal	24	Ton	$100.00	$2,400
10	Control of Water (Coordination with District)	1	Lump Sum	$15,000.00	$15,000
11	Channel Excavation	17,000	Ton	$6.00	$102,000
12	Bank and Bench Excavation	71,000	Ton	$3.00	$213,000
13	Instream Structure Excavation	7,000	Ton	$9.00	$63,000
14	Type 3 Boulder Removal and Salvage	200	Each	$30.00	$6,000
15	Soil Disposal	46,200	Ton	$16.50	$762,300
16	Toxic Constituent Disposal	38,000	Ton	$65.00	$2,470,000
17	Soil Loosening	300,000	Square Foot	$0.04	$12,000
18	Channel Embankment Construction	5,000	Ton	$30.00	$150,000
19	Bench Construction	3,700	Ton	$35.00	$129,500
20	Streambed Construction	7,300	Ton	$36.00	$262,800
21	Bar Construction	5,000	Square Foot	$3.00	$15,000
22	Topsoil Fill	6,000	Ton	$18.00	$108,000
23	Bank Protection	750	Linear Foot	$270.00	$202,500
24	Rock Slope Protection	100	Ton	$45.00	$4,500
25	Percolation Pond Construction	1	Lump Sum	$250,000.00	$250,000
26	Infrastructure Modifications	1	Lump Sum	$50,000.00	$50,000
27	Stream Boulder Placement	150	Each	$35.00	$5,250
28	Cross Weir	15	Each	$5,000.00	$75,000

29	V-Weirs	10	Each	$4,500.00	$45,000
30	Wing Deflector	4	Each	$1,500.00	$6,000
31	Log Stream Barb	30	Each	$1,400.00	$42,000
32	Rock Stream Barbs	24	Each	$2,200.00	$52,800
33	Waters Edge Treatment	3,000	Linear Foot	$20.00	$60,000
34	Buried Groins	335	Ton	$75.00	$25,125
35	Rootwad Bank Structure - Type 1	71	Each	$2,800.00	$198,800
36	Rootwad Bank Structure - Type 2	9	Each	$2,700.00	$24,300
37	Bar IWM	150	Each	$850.00	$127,500
38	Stream IWM	9	Each	$800.00	$7,200
39	Overbank Woody Material	12	Each	$2,300.00	$27,600
40	Log Toe Bank Structure	18	Each	$2,000.00	$36,000
41	Off-bank Branch Cover	45	Each	$800.00	$36,000
42	Off-bank Log Cover	8	Each	$800.00	$6,400
43	Remove, Salvage, and Reinstall Chain Link Fence	800	Linear Foot	$20.00	$16,000
44	Chain Link Fence	120	Linear Foot	$25.00	$3,000
45	Water Service Point	2	Each	$20,000.00	$40,000
46	Meter	2	Each	$5,000.00	$10,000
47	Backflow Assembly	2	Each	$8,000.00	$16,000
48	Main Line	18,000	Linear Foot	$12.00	$216,000
49	Bubbler Irrigation System	300,000	Square Foot	$1.50	$450,000
50	Supplemental Watering (Construction Period)	4	Per Event	$5,000.00	$20,000
51	Type 1 Cutting Collection and Storage	3,715	Each	$5.00	$18,575
52	Type 2 Cutting Collection and Storage	2,023	Each	$5.00	$10,115
53	Type 1 Cutting Installation	3,715	Each	$12.00	$44,580
54	Type 2 Cutting Installation on Bench	445	Each	$15.00	$6,675
55	Type 2 Cutting Installation on Slope	772	Each	$15.00	$11,580
56	Type 2 Cutting Installation on Bank	806	Each	$12.00	$9,672
57	Brush Layer Collection and Storage	100	Each	$20.00	$2,000
58	Brush Layer Installation	100	Each	$50.00	$5,000

59	Willow Wattles (20-foot lengths)	20	Each	$2,500.00	$50,000
60	Container Plant Installation on Bench	5,122	Each	$15.00	$76,830
61	Container Plant Installation on Slope	3,895	Each	$15.00	$58,425
62	Container Plant Installation on Bank	1,297	Each	$15.00	$19,455
63	Acorn Planting	206	Each	$12.00	$2,472
64	Transplanting	152	Each	$1,000.00	$152,000
65	Seeding	20	Acre	$2,000.00	$40,000
66	Weed Control (3-year Maintenance Period)	12	Month	$5,000.00	$60,000
67	Irrigation Operation (3-yearMaintenance Period)	21	Month	$1,200.00	$25,200
68	Supplemental Watering (3-yearMaintenance Period)	18	Per Event	$5,000.00	$90,000
69	Replacement Planting (3-yearMaintenance Period)	5500	Each	$25.00	$137,500
70	Reseeding (Maintenance Period)	275,000	Square Foot	$0.05	$13,750
71	Plant Establishment Forms	36	Each	$500.00	$18,000
72	Record Drawings	1	Set	$15,000.00	$15,000
Subtotal					$7,720,500
Quantity and Unit Cost Contingency					$772,050
Total Estimated Cost					**$8,492,550**

Notes:

This cost estimate is based on the Draft Submittal Construction Documents (i.e., plans & specifications) prepared by Jones & Stokes and Northwest Hydraulic Consultants, dated July 19, 2000, and conceptual changes developed for the recommended project based on comments received form District staff.

This cost estimate does not include subsequent phases of the project.

This cost estimate is a planning tool to assess the level of effort required to perform the work. This estimate is preliminary, and actual costs may vary by an order of magnitude. Actual construction costs may vary from the above estimates because of competitive bidding, negotiations with the Santa Clara Valley Water District, or fluctuations in market prices. This estimate is not a bid.

Total costs have been rounded off for order-of-magnitude purposes.

This estimate does not include contingencies for soil disposal and soil management relating to hazardous materials that may be found onsite. Based on existing data, this estimate assumes that 40% of the material will be disposed of at a Class II or Class III facility.

This estimate assumes that the District will be responsible for control of water, including dewatering the creek and rerouting flows through the Los Capitancillos percolation pond system.

Chapter 8. Conclusions and Recommendations

The Santa Clara Valley Water District (District) is proposing to establish shaded riverine aquatic (SRA) cover vegetation and improve aquatic habitat in the lower reaches of Guadalupe Creek between Almaden Expressway and Masson Dam. The Guadalupe Creek Restoration Project is intended to provide SRA mitigation to offset environmental impacts associated with future District projects.

The Guadalupe Creek Restoration Project would provide shaded riverine aquatic cover vegetation and fisheries enhancements. The following are the beneficial impacts of the project.

- **Fisheries:** Restores SRA cover vegetation and improves aquatic habitat, creating and maintaining suitable water temperatures, increases organic material (e.g., leaf and insect drop), and provides habitat to support all life stages of anadromous fish.
- **Wildlife:** Restores ecological functions and enhances habitat for special-status fish and wildlife species, as consistent with other project objectives. Also restores vegetation in a reach of the creek that had previously been denuded.
- **Geomorphology:** Restores physical processes and ecological functions along the project reach of Guadalupe Creek.
- **Public works:** Protects existing infrastructure in the project area.
- **Public works:** Maintains existing flood conveyance capacity.
- **Recreation:** Project does not preclude future recreation uses that are compatible with other project objectives.
- **Environmental Health:** The project does not adversely effect environmental health within the project area.

Therefore, it is recommended that the recommended project be approved and construction plans be prepared for implementation of the project.

Chapter 9. Citations

9.1 PRINTED REFERENCES

Allen, M. A., and T. J. Hassler. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific southwest) – chinook salmon. (U.S. Fish and Wildlife Service Biological Report 82 [11.49]). U.S. Army Corps of Engineers. TR EL-82-4.

Beauchamp, D. A., M. F. Shepard, and G. B. Pauley. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) – chinook salmon. (U.S. Fish and Wildlife Service Biological Report 82 [11.6]). U.S. Army Corps of Engineers, TR EL-82-4.

Beechie, T. J., and T. H. Sibley. 1997. Relationships between channel characteristics, woody debris, and fish habitat in northwestern Washington streams. Transactions of the American Fisheries Society 126:217-229.

Bilby, R. E., and J. W. Ward. 1991. Characteristics and function of large woody debris in streams draining old-growth, clear-cut, and second-growth forests in southwestern Washington. Canadian Journal of Fisheries and Aquatic Sciences 48:2499-2508.

California State Division of Mines and Geology. 1990. Geologic map of the San Francisco - San Jose quadrangle, scale 1:250,000.

__________. 1992. Landslides and other geologic features in the Santa Cruz Mountains, California, resulting from the Loma Prieta earthquake of October 17, 1989. Open file report 91-05.

Chang, Howard. 1992. Fluvial processes in river engineering. Krieger Publishing Company. Malabar, FL.

City of San Jose. 1994. Department of Planning, Building and Code Enforcement. San Jose 2020 general plan. San Jose, CA.

Collins, B., and T. Dunne. 1990. Fluvial geomorphology and river gravel mining: a guide for planners, case studies included. California State Division of Mines and Geology, Special Publication 98. CA.

Cunnane, C. 1978. Unbiased plotting positions: a review. Journal of Hydrology 37:205-222.

Crispin, V., R. House, and D. Roberts. 1993. Changes in instream habitat, large woody debris, and salmon habitat after the restructuring of a coastal Oregon stream. North American Journal of Fisheries Management 13:96-102.

Dolloff, C. A. 1994. Large woody debris–the common denominator for integrated environmental management of forest streams. Pages 93-108 in John Cairns Jr., Todd V. Crawford, and Hal Salwasser (eds), Implementing Integrated Environmental Management. Center for Environmental and Hazardous Materials Studies, Virginia Polytechnic Institute and State University. Blacksburg, VA.

Einstein, H. A. 1950. The bed-load function for sediment transportation in open channels. (Technical Bulletin 1026.) U.S. Soil Conservation Service. Washington, D.C.

Fausch, K. D., and T. G. Northcote. 1992. Large woody debris and salmonid habitat in a small coastal British Columbia stream. Canadian Journal of Fisheries and Aquatic Sciences 49:682-693.

Harrington, J. P. 1942. Culture element distributions: XIX, Central California Coast. Anthropological Records 7:1-46.

Holland, R. 1986. Preliminary descriptions of the terrestrial natural communities of California. Unpublished report. State of California Department of Fish and Game, Natural Heritage Division. Sacramento, CA.

Hydrologic Engineering Center. 1992. HEC-FFA: Flood frequency analysis user's manual. Prepared by the Hydrologic Engineering Center, Davis, CA. Reproduced by Department of Commerce Springfield, VA.

__________. 1998. HEC-RAS River Analysis System, Version 2.2. Davis, CA.

Keeler-Wolf, T., K. Lewis, and C. Roye. 1997. The definition of Central California sycamore alluvial woodland. May 1997. Prepared by California Department of Fish and Game. Sacramento, CA. Prepared for California Department of Water Resources. Sacramento, CA.

Kroeber, A. L. 1925. Handbook of the Indians of California. Bureau of American Ethnology (Bulletin 78.) Smithsonian Institution Washington, D.C.

Jones & Stokes Associates Inc. November 4, 1998. Letter report: Fish habitat accessibility in the Guadalupe River and Guadalupe Creek. Prepared by Karen Leone. Sacramento, CA.

Leidy, R. A. 1984. Distribution and ecology of stream fishes in the San Francisco Bay drainage. Higardia 52(8): 1-175.

Leopold, L. B., M. G. Wolman, and J. P. Miller. 1964. Fluvial processes in geomorphology. Freeman. San Francisco, CA.

Margolin, M. 1978. The Ohlone way. Indian Life in the San Francisco-Monterey Bay Area. Heydey Books. Berkeley, CA.

McBride, J. R, and J. Strahan. 1984. Establishment and survival of woody vegetation species on gravel bars of an intermittent steam. American Midland Naturalist 112:235-245.

Meyer-Peter, E., and R. Muller. 1948. Formulas for bed-load transport. Pages 39-64 in Proceedings of the 3rd Meeting International Association of Hydraulic Research. Stockholm, Sweden.

Moyle, P. B. 1976. Inland fishes of California. University of California Press. Berkeley, CA.

Nielsen, J. L. 1995. Salmon from the Sacramento-San Joaquin Basin and Guadalupe river 1992-1994. Unpublished report. Hopkins Marine Station, Department of Biology, Stanford University. Palo Alto, CA.

Norris, R. M., and Webb, R. W. 1990. Geology of California. 2nd edition. John Wiley & Sons. New York, NY.

Philip Williams & Associates Ltd. 1993. Sediment assessment study of the Upper Guadalupe River. Prepared by Joan Florsheim, Peter Goodwin, Han-Bin Liang, and Tamara Rose. San Francisco, CA. Prepared for the U.S. Army Corps of Engineers. San Francisco, CA.

Proffitt, G. T., and A. J. Sutherland. 1983. Transport of non-uniform sediments. Journal of Hydraulic Research 21(1):33-43.

Radbruch, D. H., and K. C. Crowther. 1973. Map showing areas of estimated relative amounts of landslides in California. Miscellaneous geologic investigations map I-747, scale 1:1,000,000.

Raleigh, R. F., T. Hickman, R.C. Solomon, and P.C. Nelson. 1984. Habitat suitability information: rainbow trout. (FWS/OBS-82d/10.60.) U.S. Fish and Wildlife Service, Division of Biological Services. Washington, D.C.

__________. 1986. Habitat suitability index models and instream flow suitability curves: chinook salmon. (FWS/OBS-82/10.122). U.S. Fish and Wildlife Service, Division of Biological Services. Washington, D.C.

Reed, P. B., Jr. 1988. National list of plant species that occur in wetlands: California (Region 0). (FWS/88/26.10). U. S. Fish and Wildlife Service. Fort Collins, CO.

Reichenbacher, F.W. 1984. Ecology and evolution of southwestern riparian plant communities. Desert Plants 6:15-23.

Robison, E. G., and R. L. Beschta. 1990. Characteristics of coarse woody debris for several coastal streams of southeast Alaska, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences 47:1684-1693.

Rosgen, Dave. 1996. Applied river morphology. Wildland Hydrology. Pagosa Springs, CO.

San Francisco Regional Water Quality Control Board. 1998a. Mines report. Groundwater Protection and Waste Containment Division. April 1998.

Santa Clara Valley Water Conservation District. 1964. Los Capitancillos percolation area distribution system general plans. Scale: 1" = 200' to 1" = 1', 9 sheets.

Santa Clara Valley Water District. 1933. Revised application to Civil Works Administration and report on Guadalupe percolation dam project of Santa Clara Valley Water Conservation District. (Project Report 15) December 8, 1933.

__________. 1972. Map and general construction plan for Guadalupe Creek from Almaden Expressway to 6,600 +/- upstream in Santa Clara County, California. Central Flood Control Zone Project No. 30026. Prepared by Santa Clara Valley Water District. San Jose, CA.

__________. 1994. Hydrology documentation for the Guadalupe River watershed, April 1994. Prepared by Santa Clara Valley Water District. San Jose, CA.

__________. 1995a. Depth to water, land subsidence, population. Informational color chart.

__________. 1995b. Draft environmental impact report, instream recharge program, volume II, technical appendices. Prepared by H.T. Harvey and Associates. Alviso, CA.

__________. 1997. Environmental impact report/environmental impact statement for the upper Guadalupe River Flood control project. Draft. San Jose, CA.

__________. 1999. Water operations report including 1999 operations plan and summary of 1998 operations. May 1999. Prepared by Santa Clara Valley Water District. San Jose, CA.

__________. 2000. Guadalupe Creek water distribution. Prepared by Joe Aguilera, San Jose, CA.

Santa Clara Valley Water District and U.S. Army Corps of Engineers (SF District). 1998. Upper Guadalupe River, final feasibility report and environmental impact statement/report. January 1998. San Francisco, CA.

Sawyer, J. O., and T. Keeler-Wolff. 1995. A manual of California vegetation. California Native Plant Society. Sacramento, CA.

Schenck, S. M., and E. W. Gifford. 1952. Karok ethnobotany. Anthropological Records 13(6): 377-392.

Schopmeyer, C. S. 1974. Seeds of woody plants in the United States. Agriculture Handbook 450. U.S. Forest Service. Washington, D.C.

Sedell, J. R., P. Bisson, F. J. Swanson, and S. V. Gregory. 1988. What we know about large trees that fall into streams and rivers. From the forest to the sea: a story of fallen trees. Pages 47-81 in (General technical report PNW; GTR-229). U.S. Forest Service, Pacific Northwest Research Station. Portland, OR.

Shapovalov, L., and A. C. Taft. 1954. The life histories of the steelhead rainbow trout (Salmo gairdneri gairdneri) and silver salmon (Oncorhynchus kisutch) with special reference to Waddell Creek, CA and recommendations regarding their management. (Fish Bulletin 98.) California Department of Fish and Game. Sacramento, CA.

Siegel, R. S., and J. H. Brock. 1988. Germination requirements of key southwestern woody riparian species. Desert Plants 10:3-8.

Skinner, J. E. 1962. An historic view of the fish and wildlife resources of the San Francisco Bay Area. (Game Water Projects Branch Report 1.) California Department of Fish and Game. Sacramento, CA.

Soil Conservation Service. 1968. Soils of Santa Clara County. Prepared by the U.S. Soil Conservation Service. Portland, OR. Prepared for the County of Santa Clara Planning Department, the Santa Clara County Flood Control and Water District, and the Black Mountain, Evergreen, and Loma Prieta Soil Conservation Districts. Morgan Hill, CA.

Stevens, M. L. 1999. The effect of nitrogen fertilization on the growth, reproduction, and nitrogen use efficiency of white root (*Carex barbarae*). Ph.D. dissertation. University of California. Davis, CA.

Teaford, M. 1930. Statement on Mono/Chukchansi burning in Madera County. Madera County School Histories, Volume 1. Madera County Library, Oakhurst, CA.

Thompson, K. 1972. Determining stream flows for fish life. Pages 31-50. Pacific Northwest River Basins Commission instream flow requirement workshop. March 15-16, 1972.

Thompson. 1865. Field survey notes for plat of the part of the Rancho Canada de los Capitancillos finally confirmed to the Guadalupe Mining Company. Prepared by U.S. Surveyor General. Washington, D.C.

U.S. Army Corps of Engineers. 1973. Flood plain information, Alamitos Creek, including Guadalupe Creek - Arroyo Calero and Santa Teresa Creek, Santa Clara County, California, San Francisco District San Francisco, CA. July.

___________. 1977. Hydrologic engineering office report Guadalupe River and Coyote Creek Santa Clara Creek, California. Prepared by the U.S. Army Corps of Engineers, San Francisco District, San Francisco, CA.

___________. 1990. Fisheries handbook of engineering requirements and biological criteria. Fish Passage Development and Evaluation Program. North Pacific Division. Portland, OR.

___________. 2000. Guadalupe River project, downtown San Jose, California mitigation and monitoring plan. March 30, 2000. Prepared by Jones & Stokes Associates. (JSA F010.) Sacramento, CA. Prepared for the U.S. Army Corps of Engineers, Sacramento District Sacramento, CA.

U.S. Department of Agriculture. 1996. Field indicators of hydric soils in the United States. Natural Resources Conservation Service. Fort Worth, TX.

U.S. Department of the Army. 1993. User's manual for the hydraulic design package for channels (SAM). Prepared by William A. Thomas, Ronald R. Copeland, Nolan K. Raphelt, and Dinah N. McComas. Vicksburg, MS. Prepared for U.S. Army Corps of Engineers Washington, D.C.

U.S. Geological Survey. 1982. Guidelines for determining flood flow frequency. Bulletin 17B of the Hydrology Subcommittee March. Reston, VA.

___________. 1988. Landslides, floods, and marine effects of the storm of January 3-5, 1982, in the San Francisco Bay region, California. (Geological Survey Professional Paper 1434.)

U.S. Environmental Protection Agency. 1997. Guadalupe river watershed planning study engineer's report. Project 3015. January 1997.

Warner, R. E., and K. M. Hendrix. 1984. California Riparian Systems. University of California Press. Berkeley, CA.

Waterways Experiments Station. 1998. Hydraulic design package for channels (SAM). April. Vicksburg, MS.

Watras, C. J., K. A. Morrison, and R. C. Back. 1996. Mass balance studies of mercury and methyl mercury in small temperate/boreal lakes of the northern hemisphere. In: Global and Regional mercury Cycles; Sources, Fluxes and Mass Balances.

Western Regional Climate Center. 1999. Period of record monthly climate summary (047821). February 14, 1999. http://www.wrcc.dri.edu/cgi-bin/cliMAIN.pl?casjos+sfo San Jose, CA.

Wolman, M. G. 1959. A method of sampling coarse river-bed material transections. American Geophysical Union 35(6).

Wolman, M. G., and J. P. Miller. 1960. Magnitude frequency of forces in geomorphic processes. Journal of Geology 68: 54-74.

Young, J. A., and C. G. Young. 1974. Seeds of woody plants in North America. Dioscorides Press.

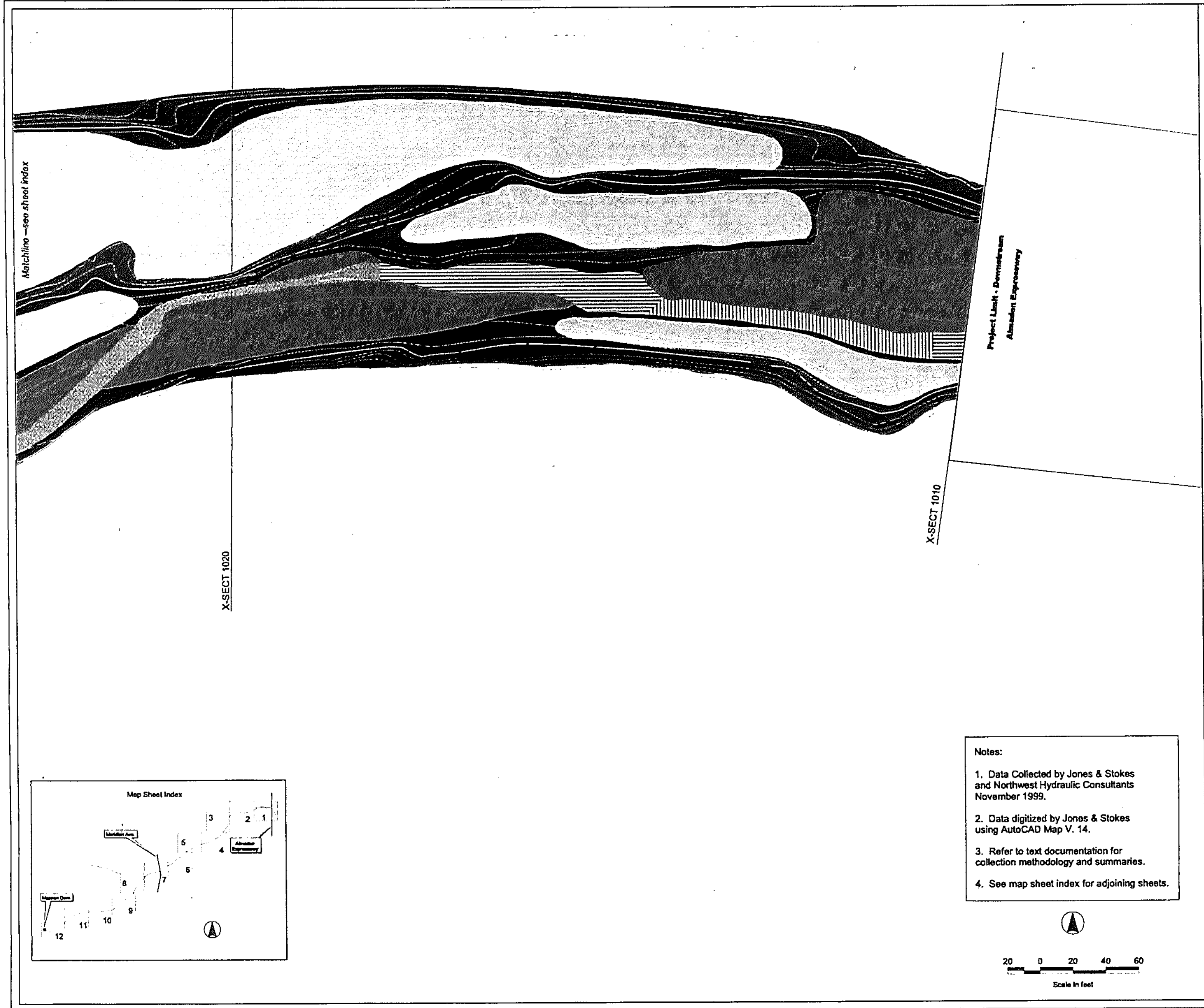
9.2 PERSONAL COMMUNICATIONS

Aguilera, Joe. Management analyst II. Santa Clara Valley Water District, San Jose, CA. January 4, 2000 - meetings and telephone conversations; March 29, 2000 - telephone conversation; March 2000 - Guadalupe Creek water distribution internal memorandum.

Martini, Ed. Vector technician. Santa Clara County Vector Control District, March 29, 2000 - telephone conversation.

Rieller, Kenn. Assistant associate engineer. Santa Clara Valley Water District, San Jose, CA. January 4, 1999 - meeting.

Appendix A. Baseline Condition Maps



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
▨ Slope
Bench
▨ Bank Protection
▨ Berm

/\/ Undercut Bank
/\/ Bank Erosion

☰ Pool
▨ Riffle
|||| Run

▨ Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

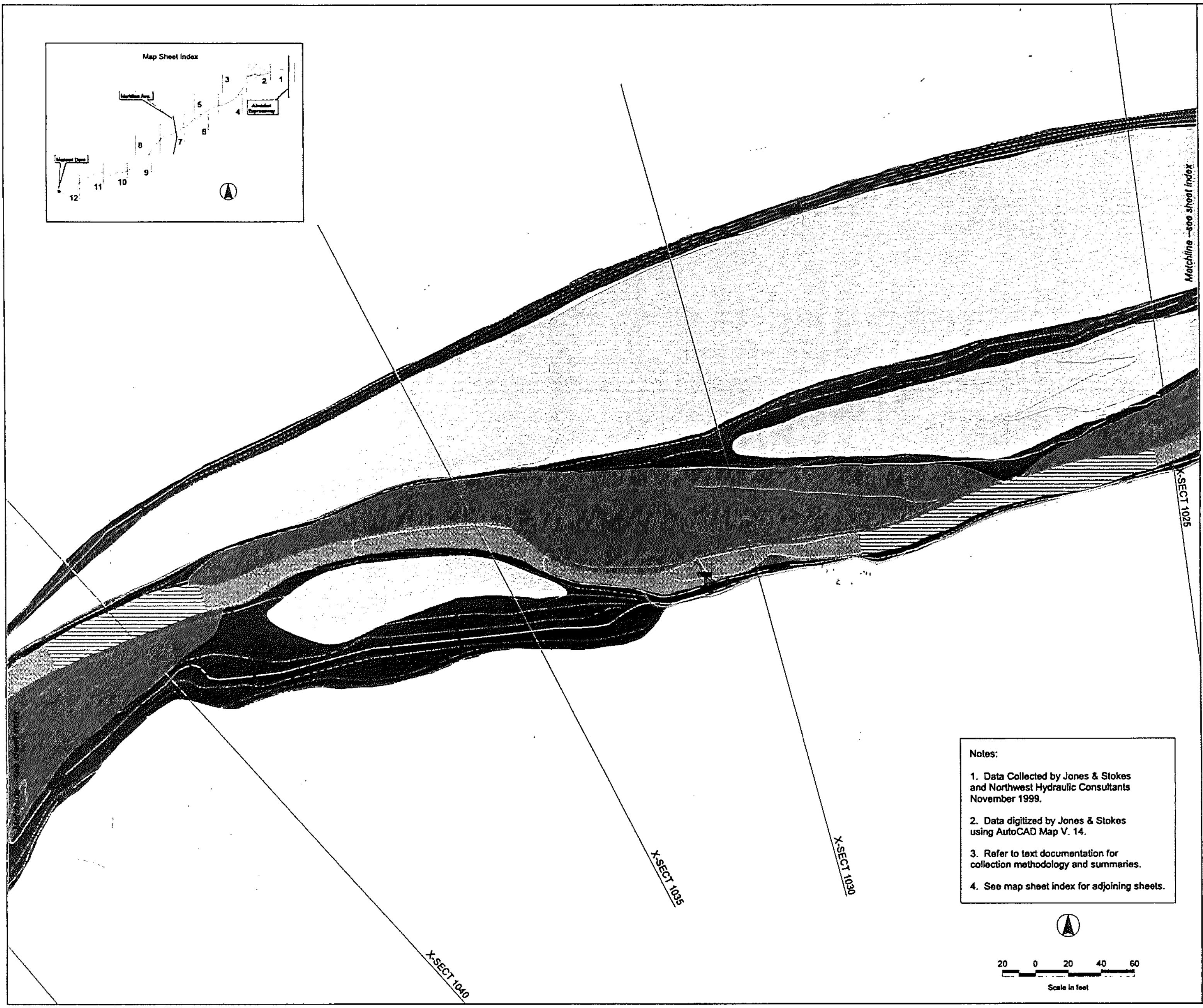
Jones & Stokes

nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat

Sheet 1 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
▨ Slope
Bench
■ Bank Protection
▨ Berm

Undercut Bank
Bank Erosion

☰ Pool
▨ Riffle
Run

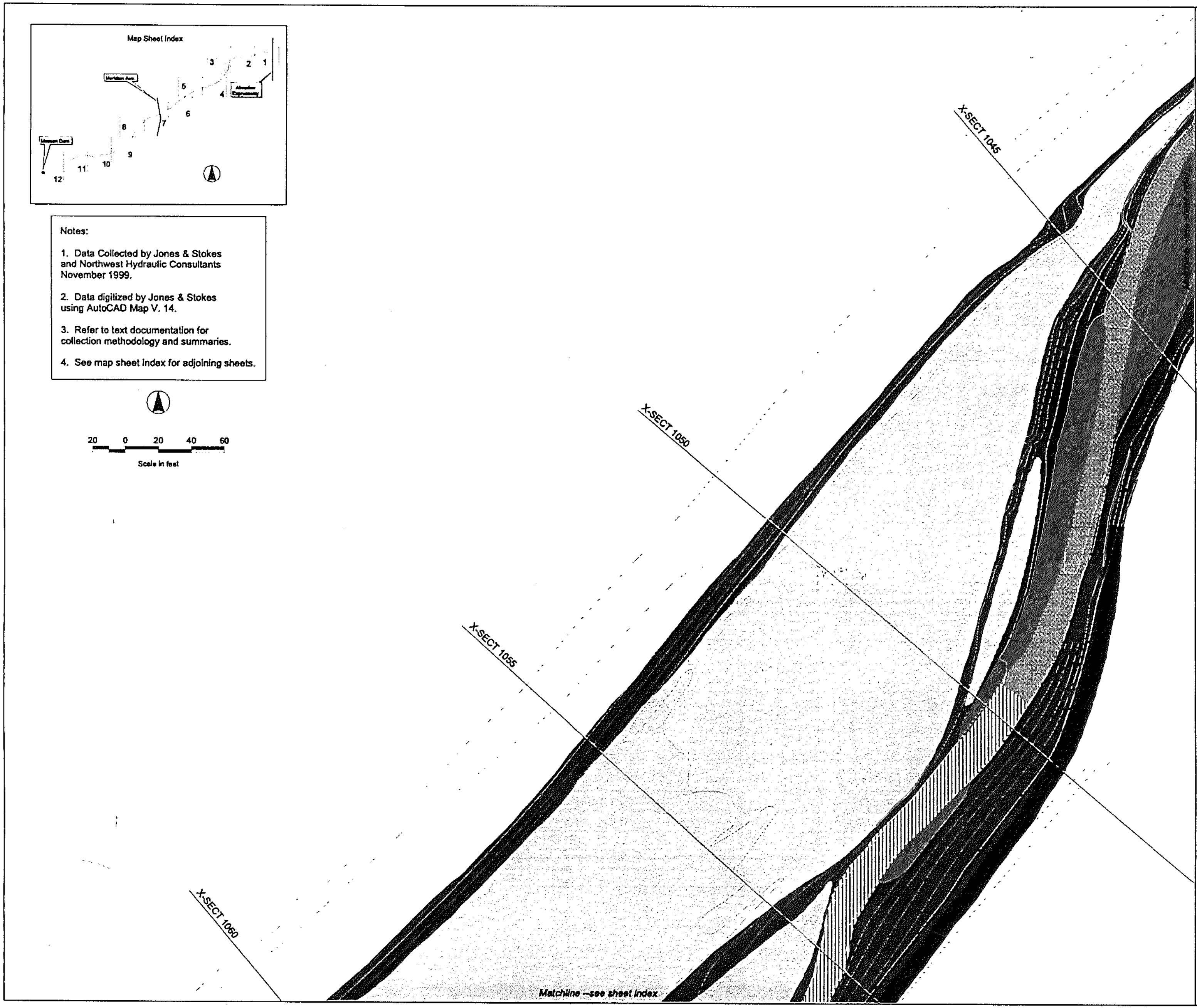
Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes
nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat
Sheet 2 of 12
March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▒ Bar
▓ Slope
Bench
█ Bank Protection
▨ Berm

⁄\⁄ Undercut Bank
⁄\⁄ Bank Erosion

☰ Pool
▒ Riffle
||||| Run

▭ Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' interval)

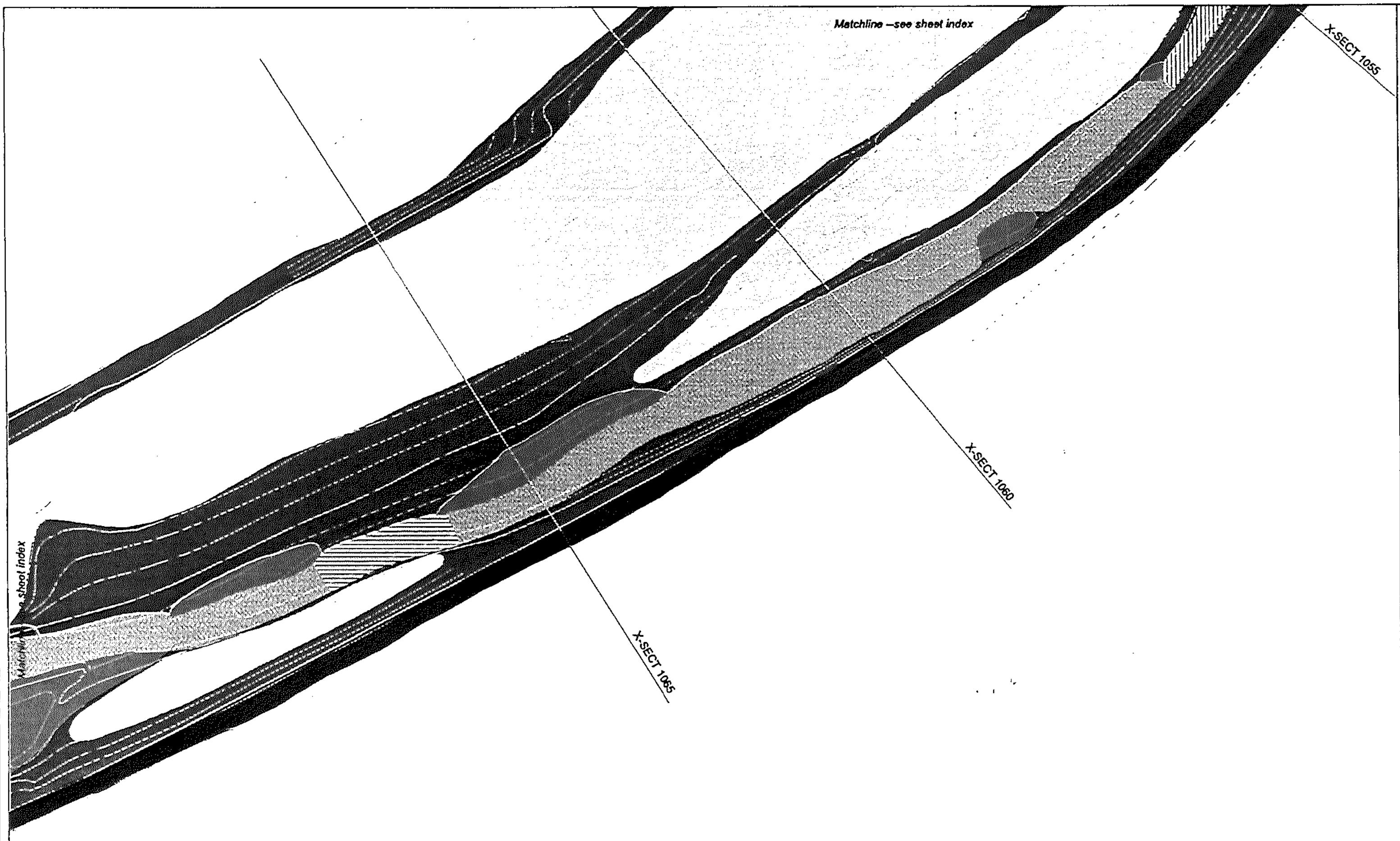
Jones & Stokes

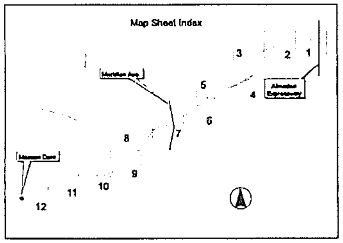
nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat

Sheet 3 of 12

March 23, 2000




Map Sheet Index

Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

20 0 20 40 60
Scale in feet

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
▨ Slope
Bench
■ Bank Protection
▨ Berm

Undercut Bank
Bank Erosion

Pool
Riffle
Run

Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

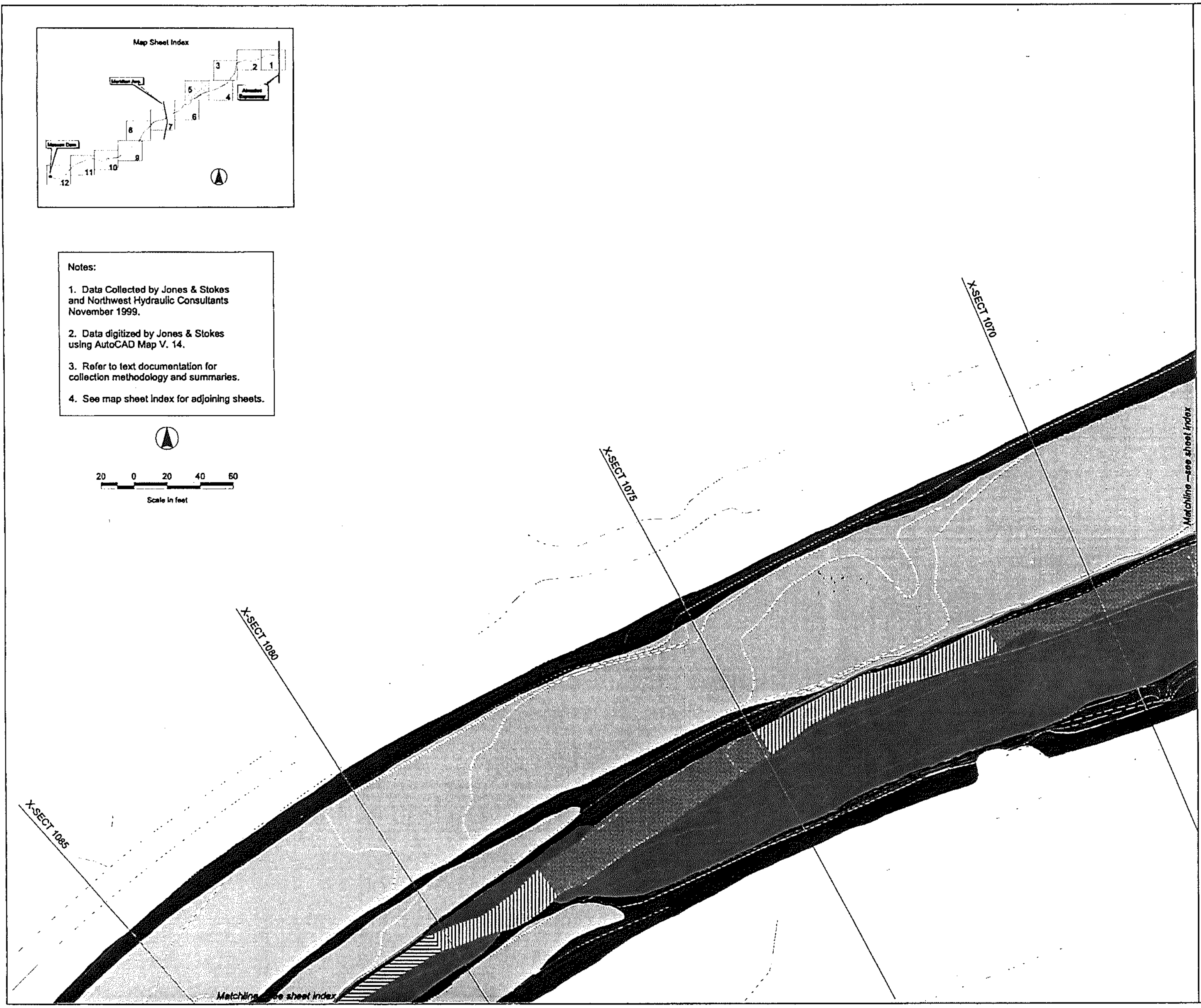
Jones & Stokes

nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat

Sheet 4 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
▨ Slope
▨ Bench
▨ Bank Protection
▨ Berm

Undercut Bank
Bank Erosion

☰ Pool
▨ Riffle
||||| Run

▨ Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

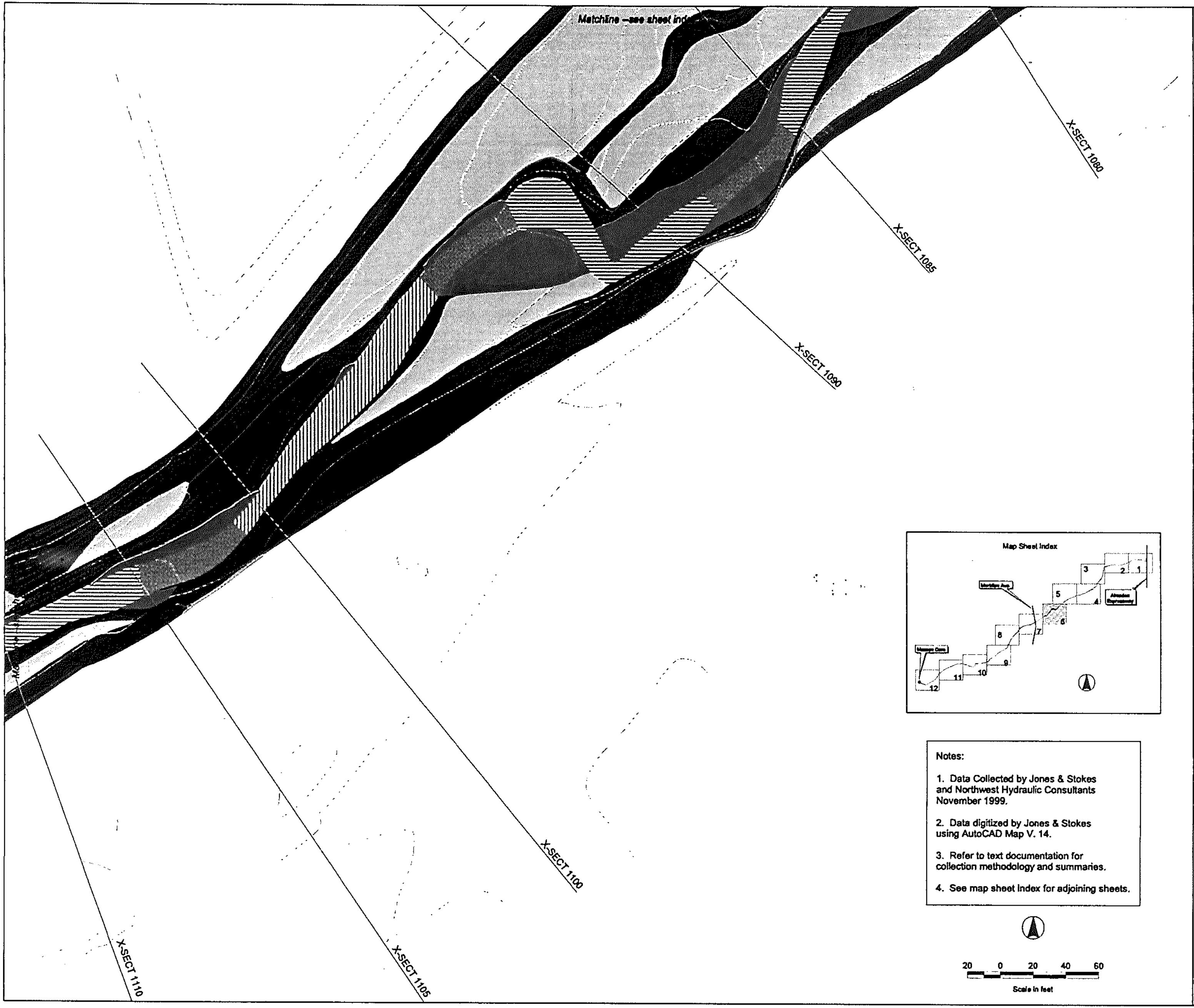
Jones & Stokes

nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat

Sheet 5 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

20 0 20 40 60

Scale in feet

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

- Low Flow Channel (November 1999)
- Bar
- Slope
- Bench
- Bank Protection
- Berm
- Undercut Bank
- Bank Erosion
- Pool
- Riffle
- Run
- Instream Woody Material
- X-SECT 1080 Cross section
- Index Contour (5' Interval)
- Contour (1' Interval)

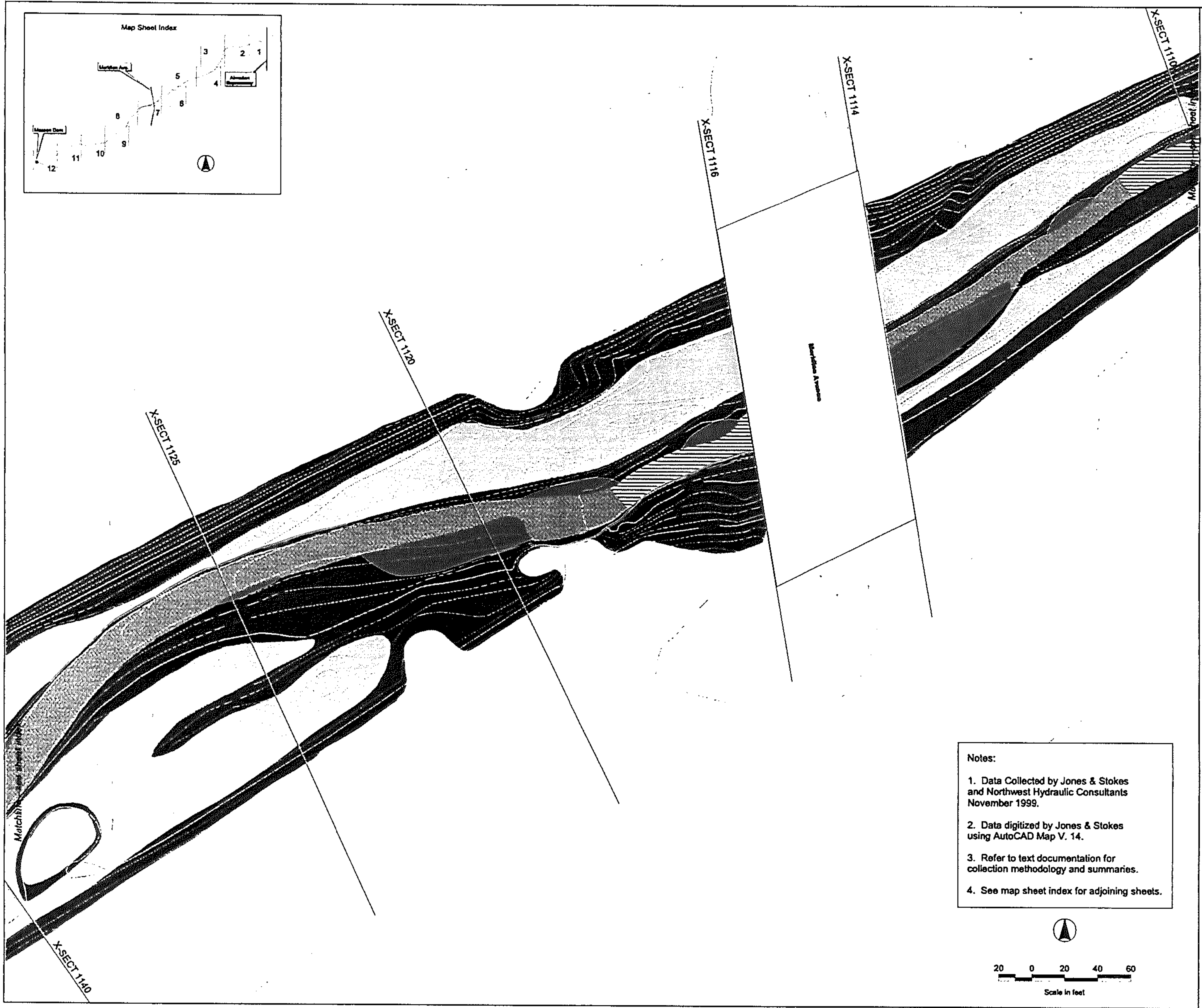
Jones & Stokes

nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat

Sheet 6 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
▨ Slope
Bench
▨ Bank Protection
▨ Berm

Undercut Bank
Bank Erosion

☰ Pool
▨ Riffle
||||| Run

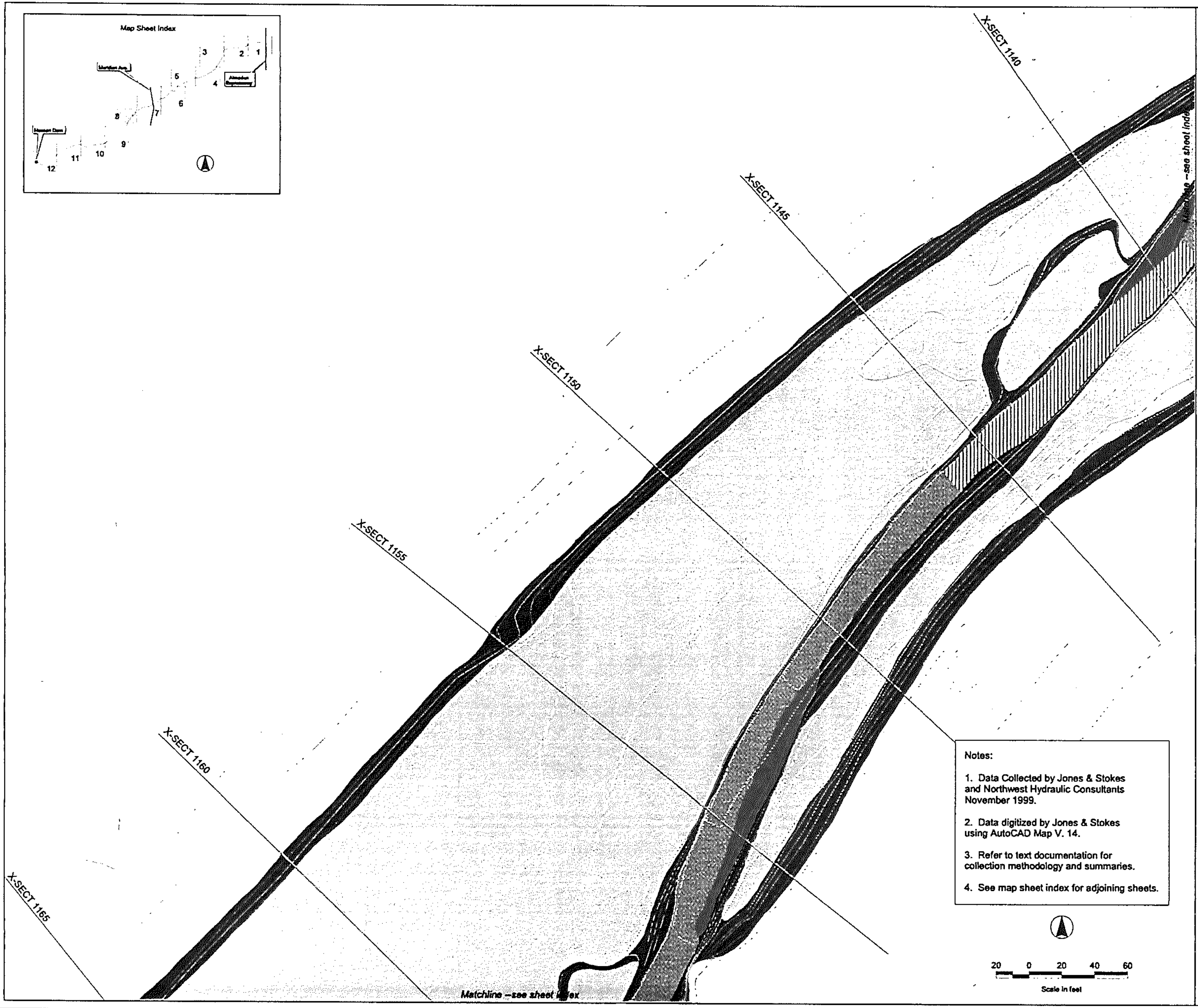
Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes
nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat
Sheet 7 of 12
March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▒ Bar
▓ Slope
Bench
█ Bank Protection
▨ Berm

Undercut Bank
Bank Erosion

☰ Pool
▒ Riffle
||||| Run

▭ Instream Woody Material

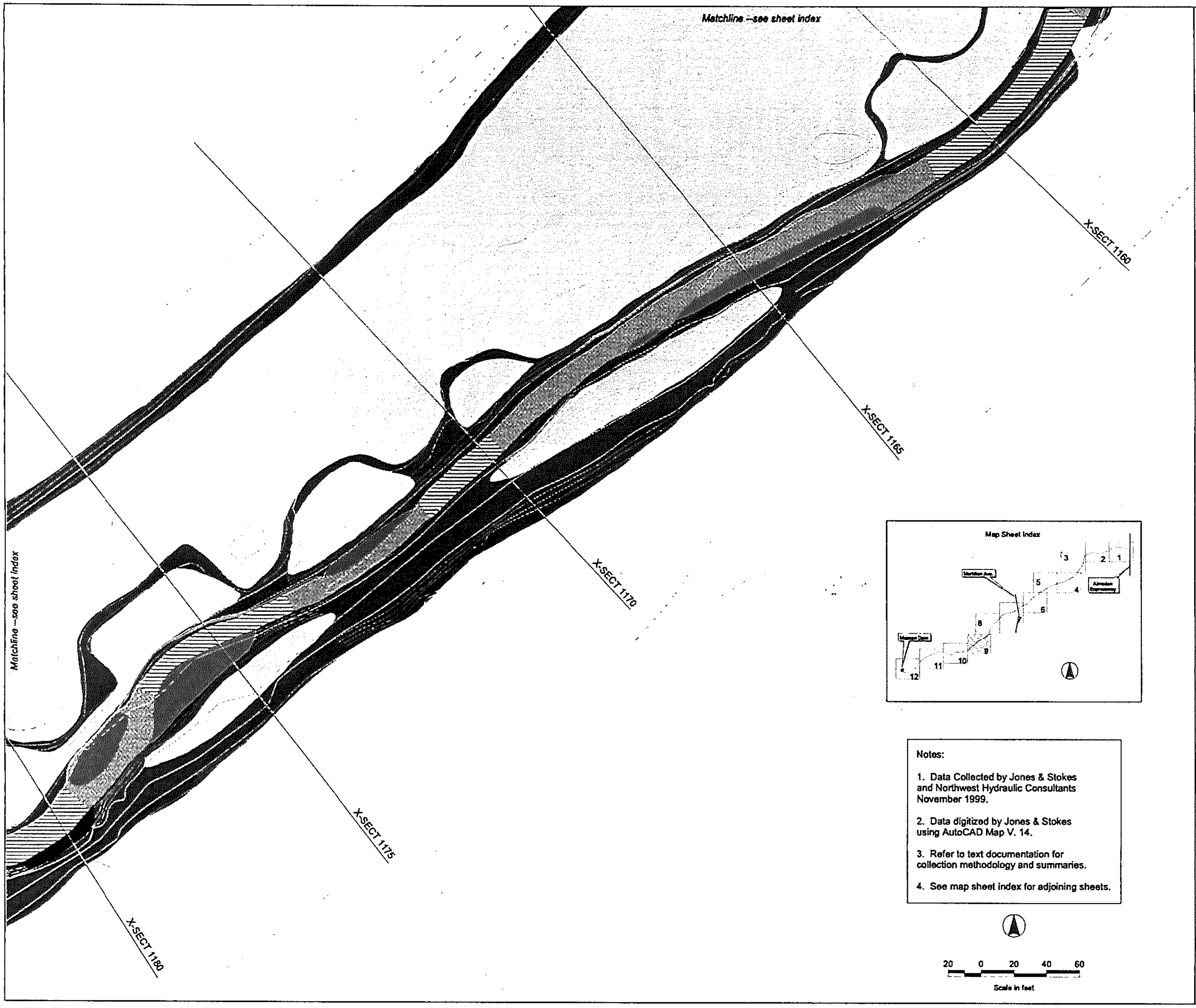
X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes

nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat
Sheet 8 of 12
March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
▨ Slope
Bench
■ Bank Protection
▨ Berm

/\/ Undercut Bank
/\/ Bank Erosion

☰ Pool
▨ Riffle
|||| Run

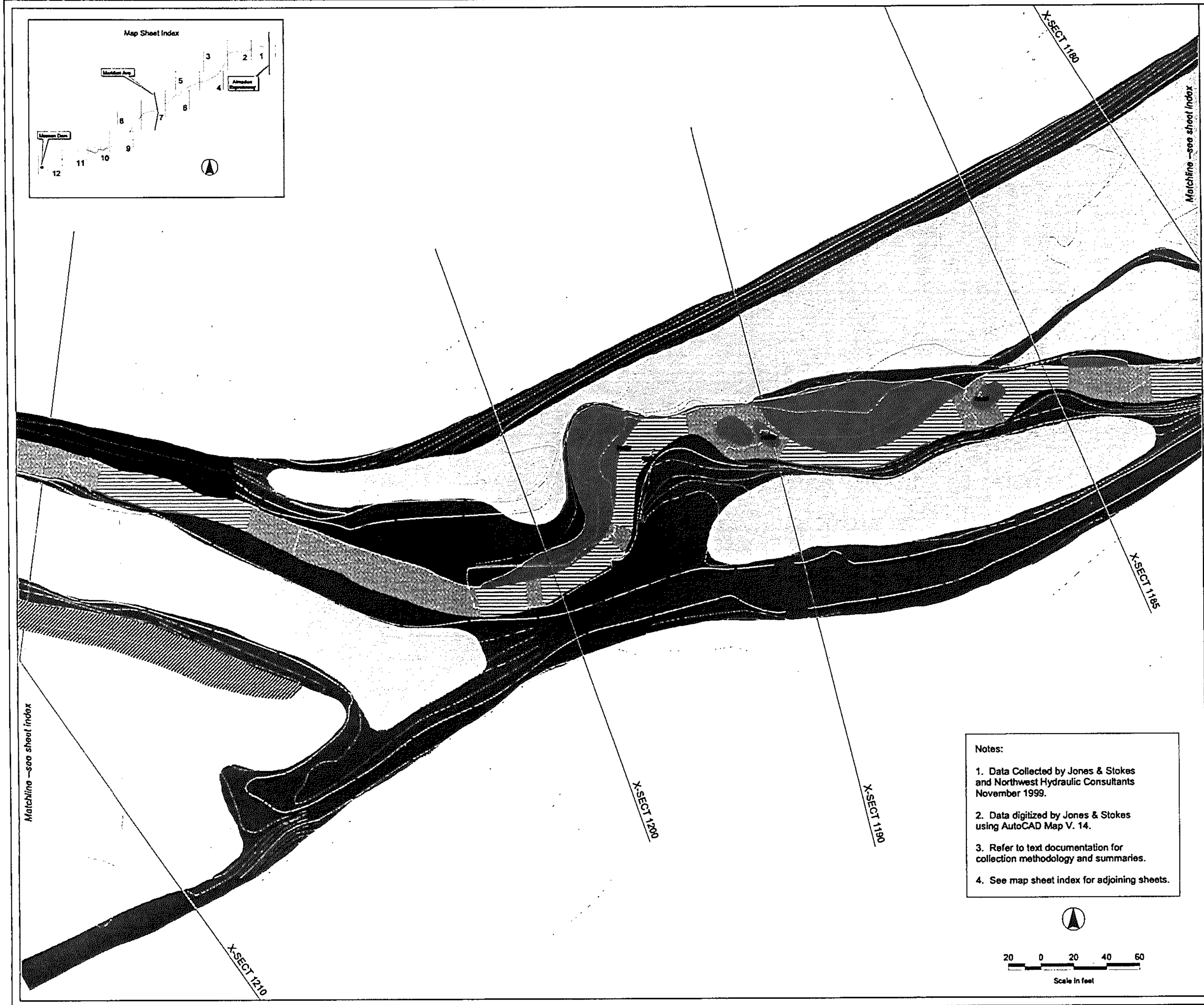
IWM Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes
nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat
Sheet 9 of 12
March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
▨ Slope
Bench
■ Bank Protection
▨ Berm

/\/ Undercut Bank
/\/ Bank Erosion

☰ Pool
▨ Riffle
||||| Run

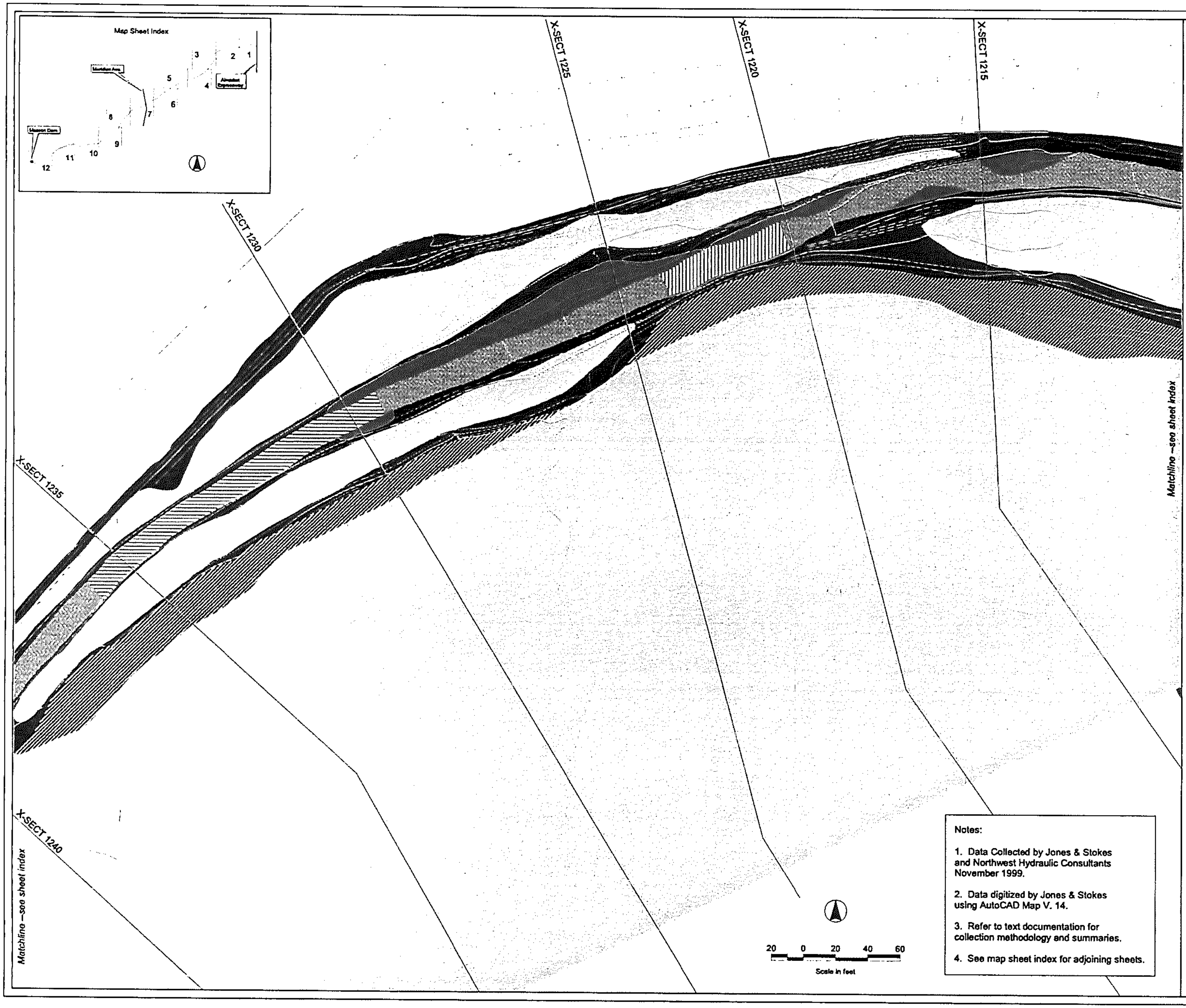
▭ Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes
nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat
Sheet 10 of 12
March 23, 2000



Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

Low Flow Channel (November 1999)
▨ Bar
■ Slope
Bench
■ Bank Protection
▨ Berm

Undercut Bank
Bank Erosion

☰ Pool
▨ Riffle
|||| Run

Instream Woody Material

X-SECT 1080 Cross section

Index Contour (5' Interval)
Contour (1' Interval)

Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

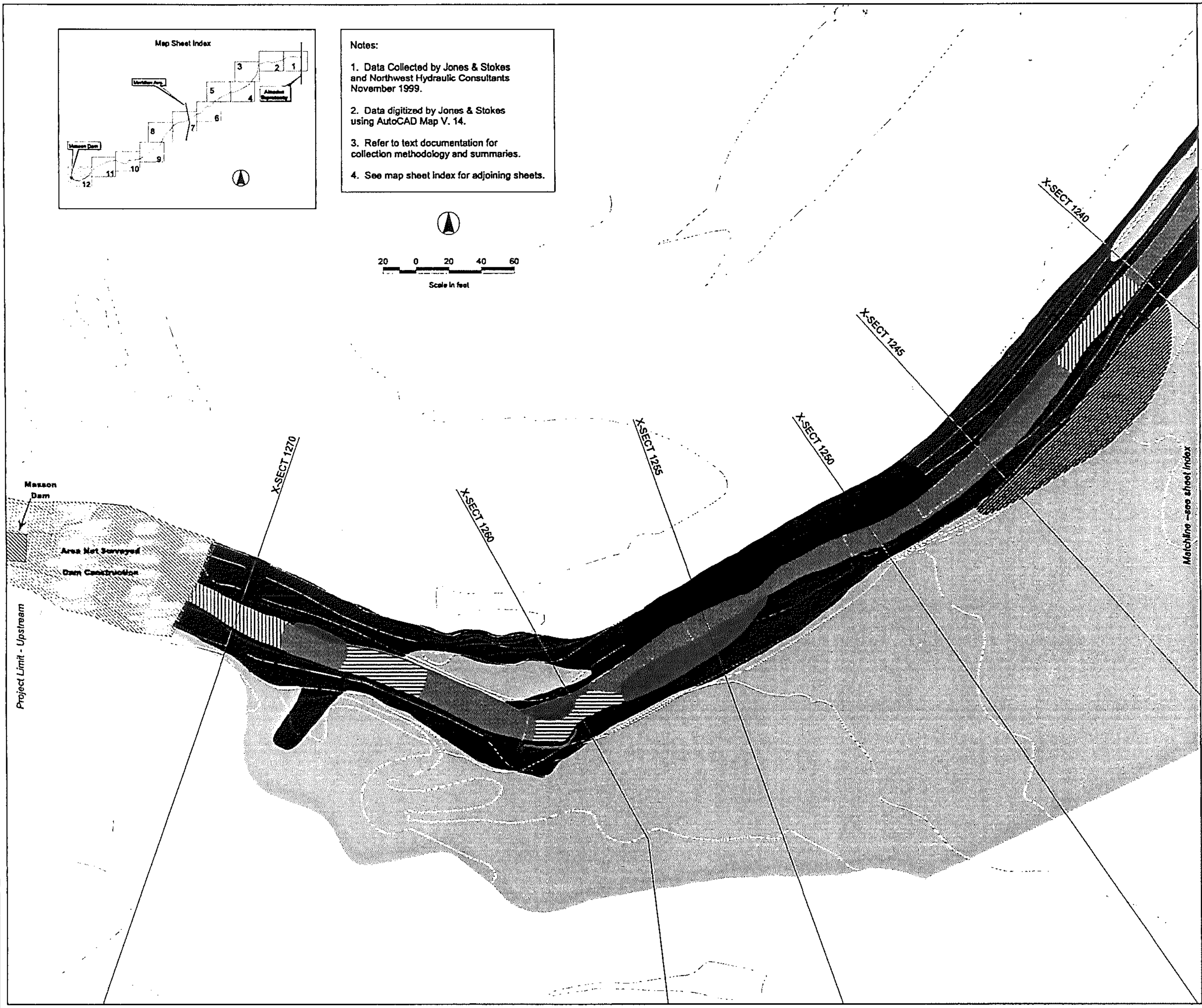
Jones & Stokes

nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat

Sheet 11 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Geomorphic and Fisheries Habitat Map

Legend

- Low Flow Channel (November 1999)
- ▩ Bar
- ▩ Slope
- ░ Bench
- ■ Bank Protection
- ▨ Berm
- /\/ Undercut Bank
- /\/ Bank Erosion
- ☰ Pool
- ▒ Riffle
- ||||| Run
- ▣ Instream Woody Material
- X-SECT 1080 Cross section
- Index Contour (5' Interval)
  Contour (1' Interval)

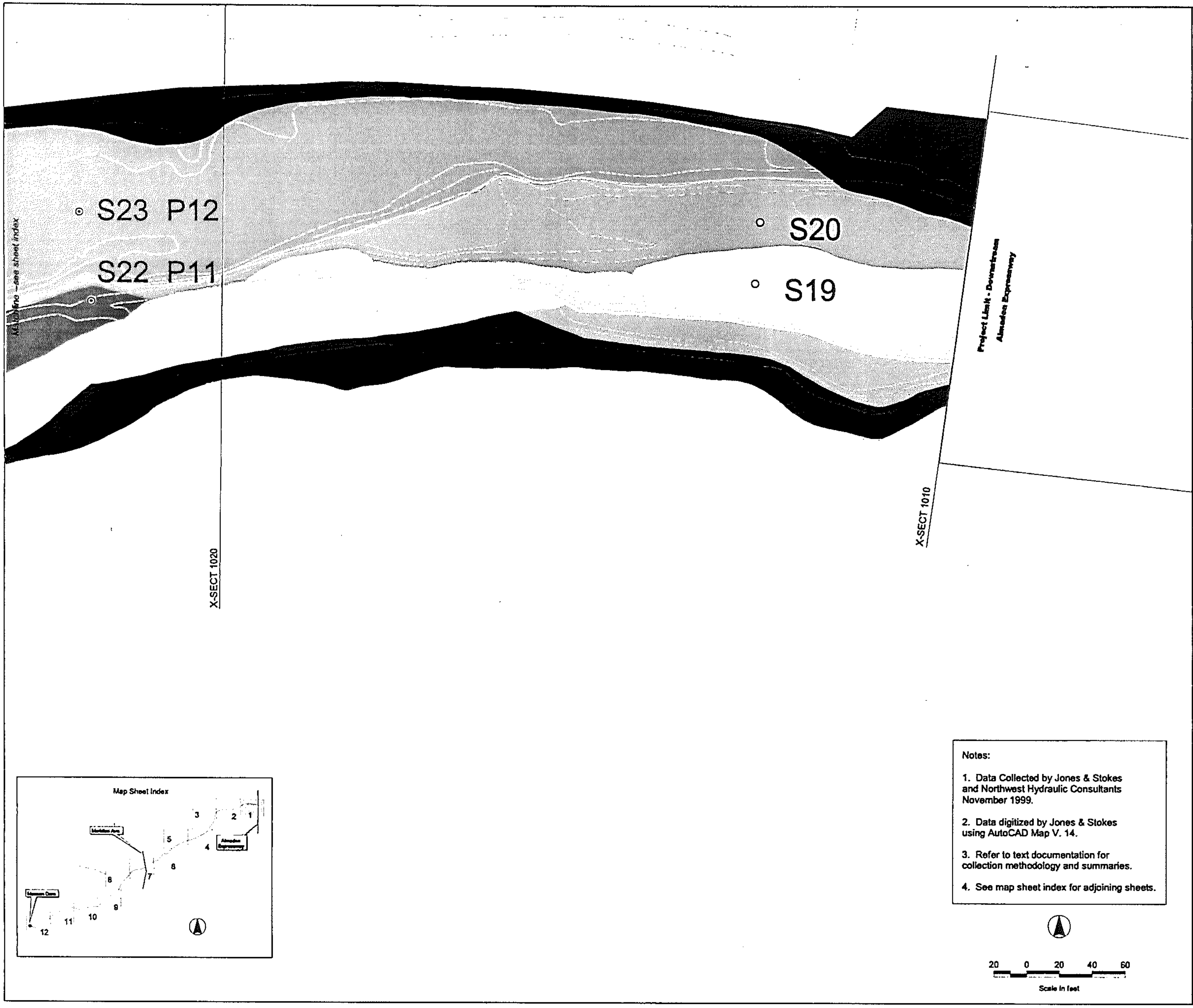
Jones & Stokes

nhc northwest hydraulic consultants

Geomorphic and Fisheries Habitat

Sheet 12 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline
Soil
Map

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

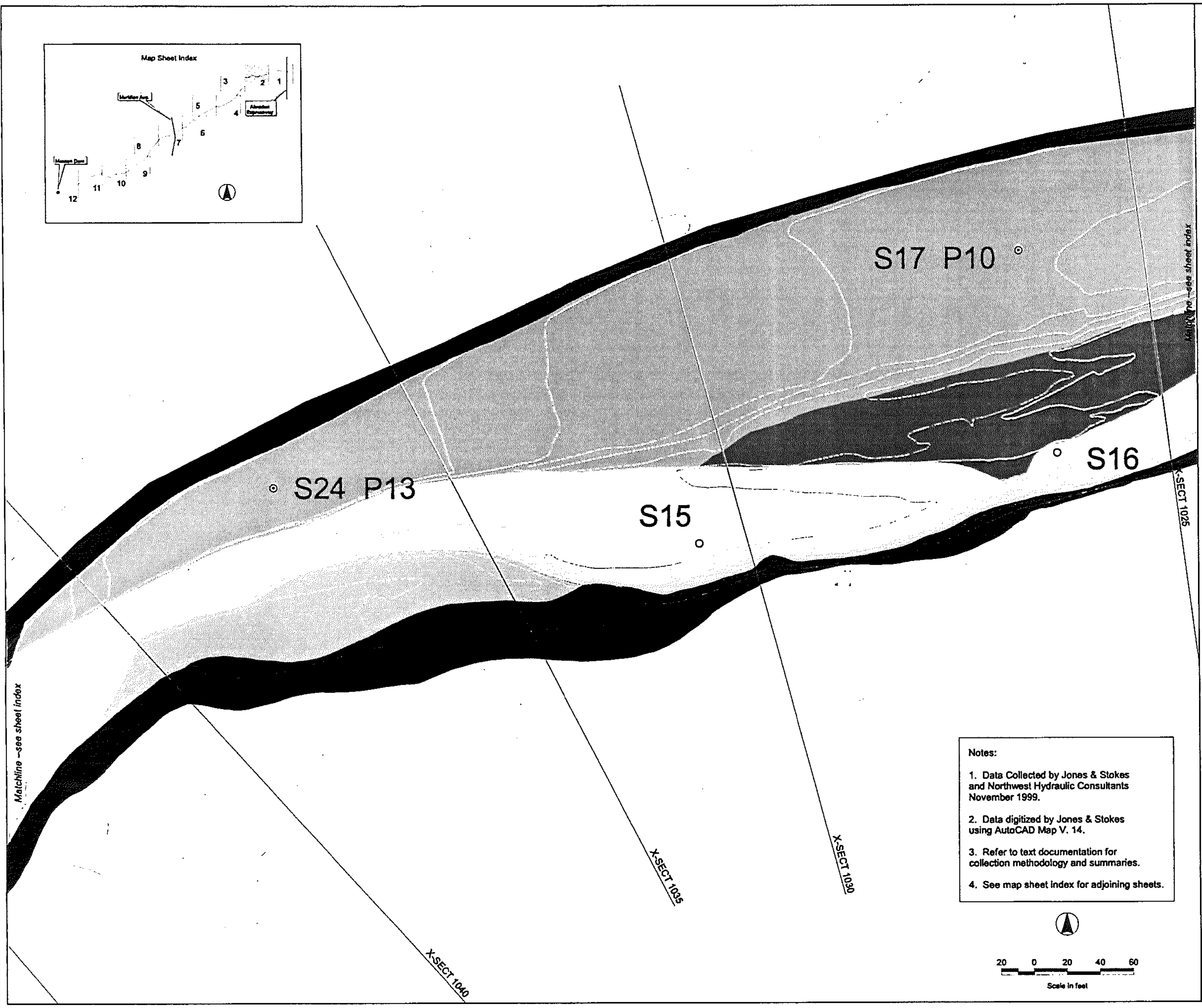
Jones & Stokes

nhc northwest hydraulic consultants

Soil

Sheet 1 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline
Soil
Map

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

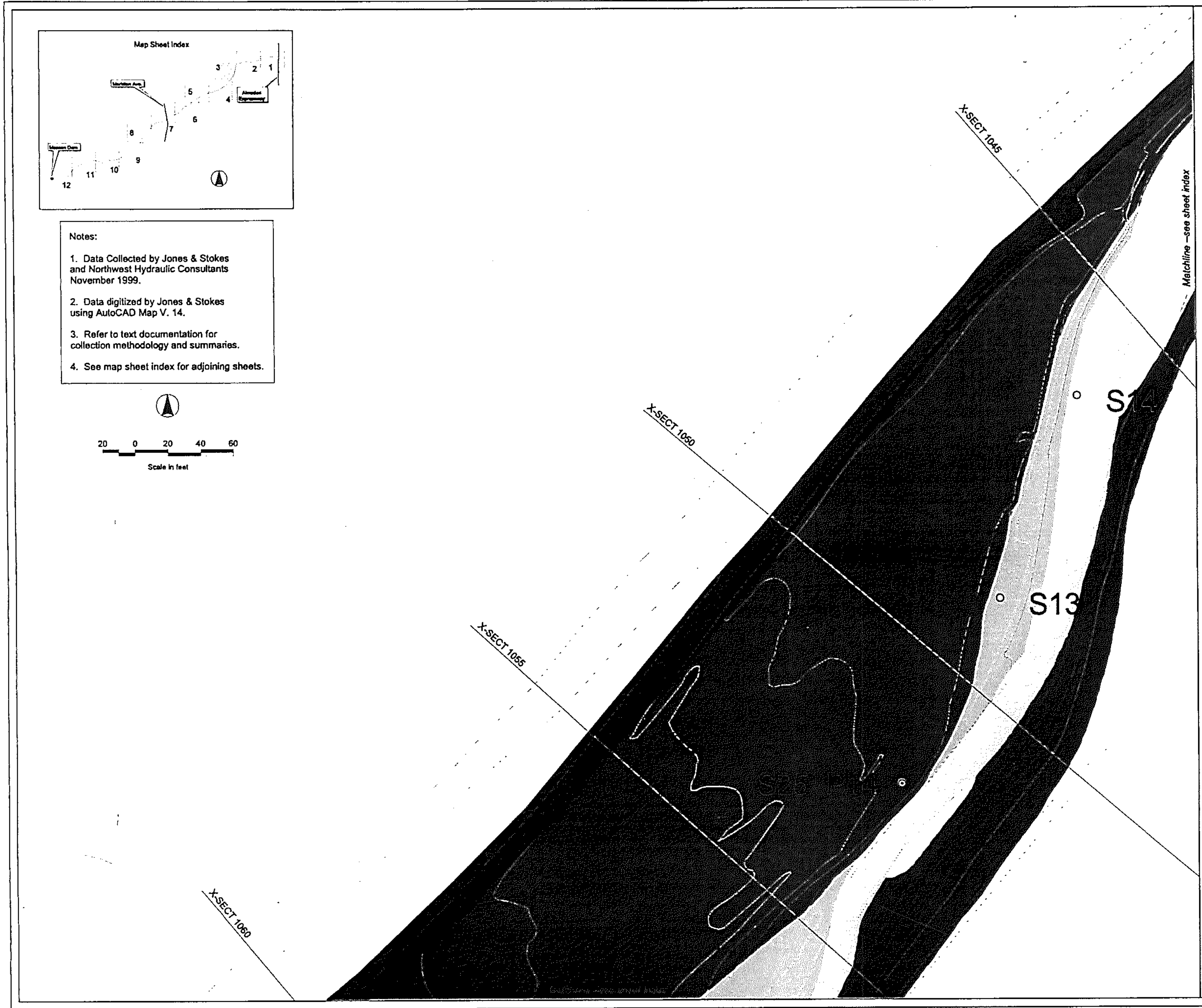
Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes
nhc northwest hydraulic consultants

Soil
Sheet 2 of 12
March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Soil Map

Legend

- ⊙ Soil Pit with Piezometer
- ○ Soil Pit without Piezometer
- ⊙ Pit_piez_loc.shp
- Low Flow (November 1999)
- ▨ Soil Map Unit A
- ▨ Soil Map Unit B
- ▨ Soil Map Unit Bd
- ▨ Soil Map Unit C
- ▨ Soil Map Unit Cc
- ▨ Soil Map Unit Cd
- ▨ Soil Map Unit D
- ▨ Soil Map Unit Dd
- ▨ Soil Map Unit E
- Index Contour (5' Interval)
- Contour (1' Interval)

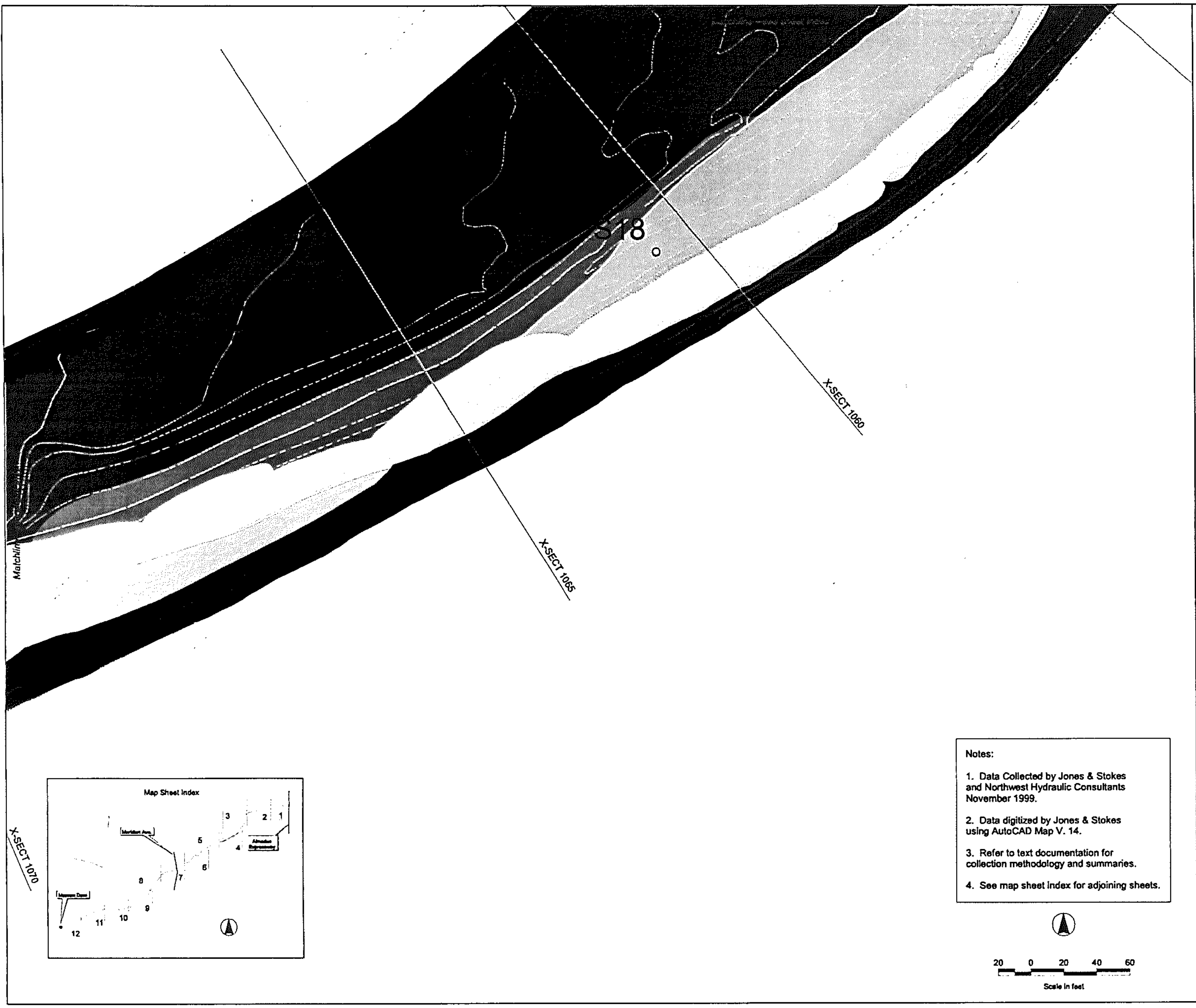
Jones & Stokes

nhc northwest hydraulic consultants

Soil

Sheet 3 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Soil Map

Legend

- ⊙ Soil Pit with Piezometer
- ○ Soil Pit without Piezometer
- ⊙ Pit_piez_loc.shp
- Low Flow (November 1999)

- ▨ Soil Map Unit A
- ▨ Soil Map Unit B
- ▨ Soil Map Unit Bd
- ▨ Soil Map Unit C
- Soil Map Unit Cc
- ▨ Soil Map Unit Cd
- ▨ Soil Map Unit D
- ▨ Soil Map Unit Dd
- ▨ Soil Map Unit E

- Index Contour (5' Interval)
- Contour (1' Interval)

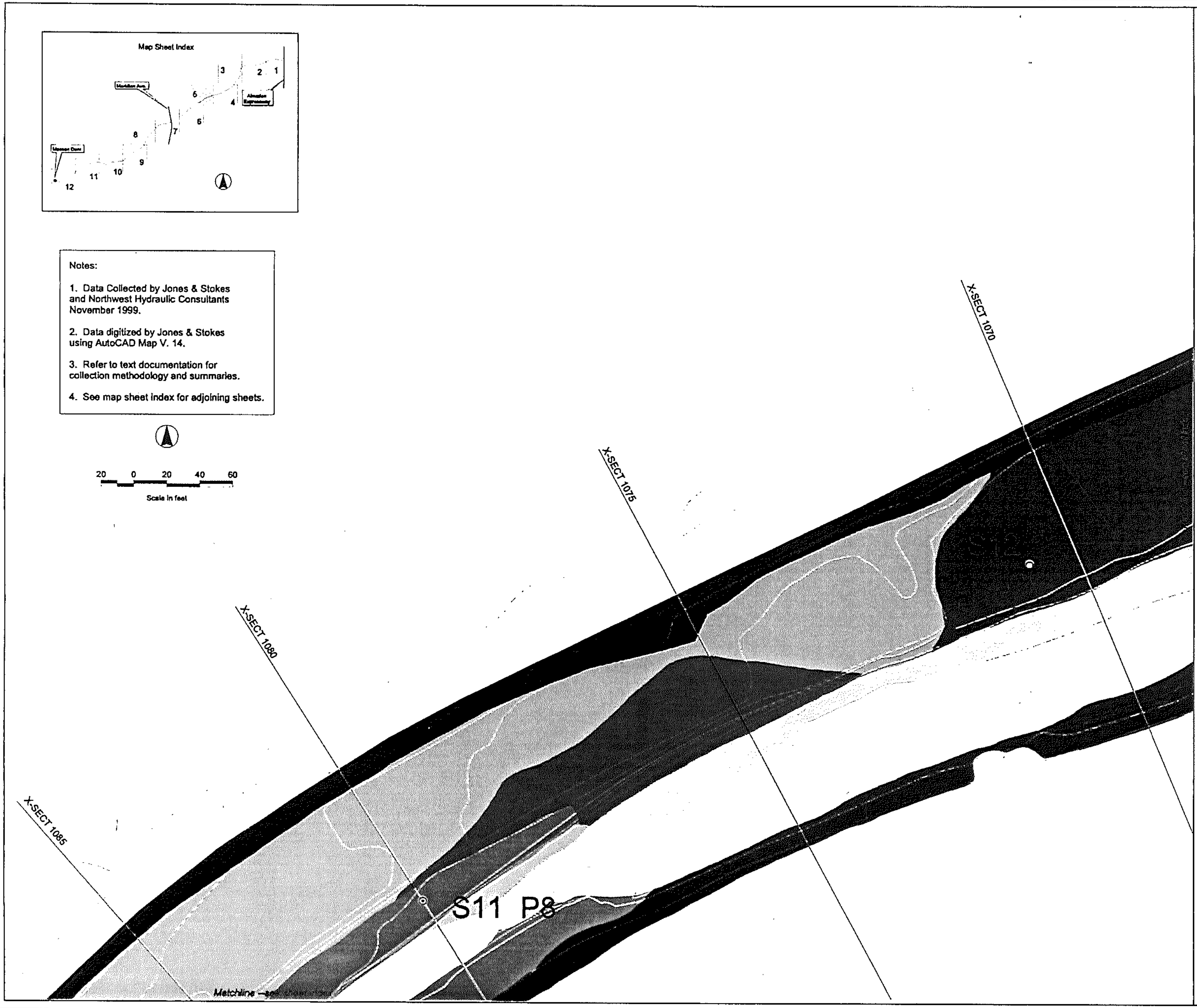
Jones & Stokes

nhc northwest hydraulic consultants

Soil

Sheet 4 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline
Soil
Map

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
▨ Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes

nhc northwest hydraulic consultants

Soil

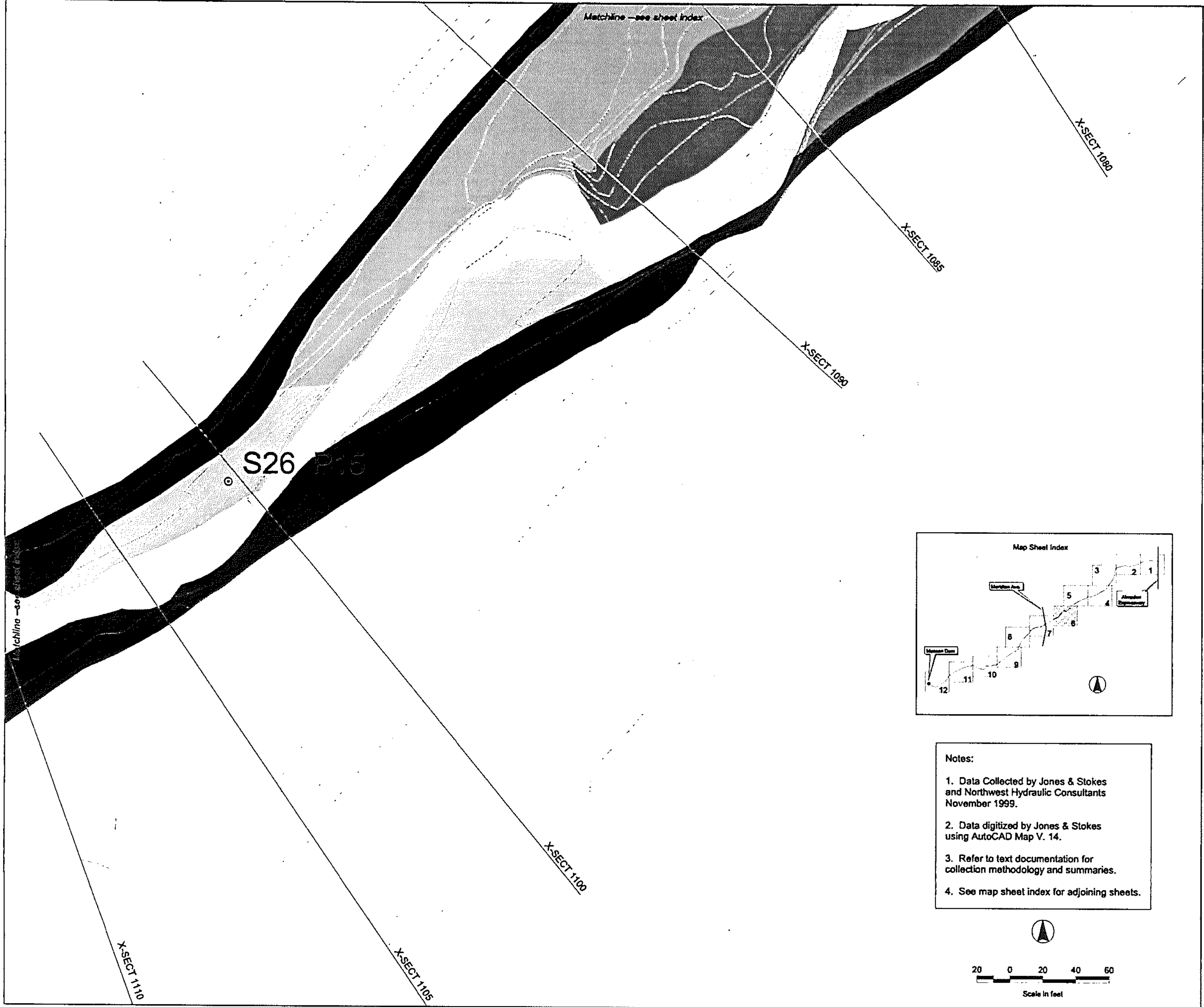
Sheet 5 of 12

March 23, 2000

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Soil Map



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

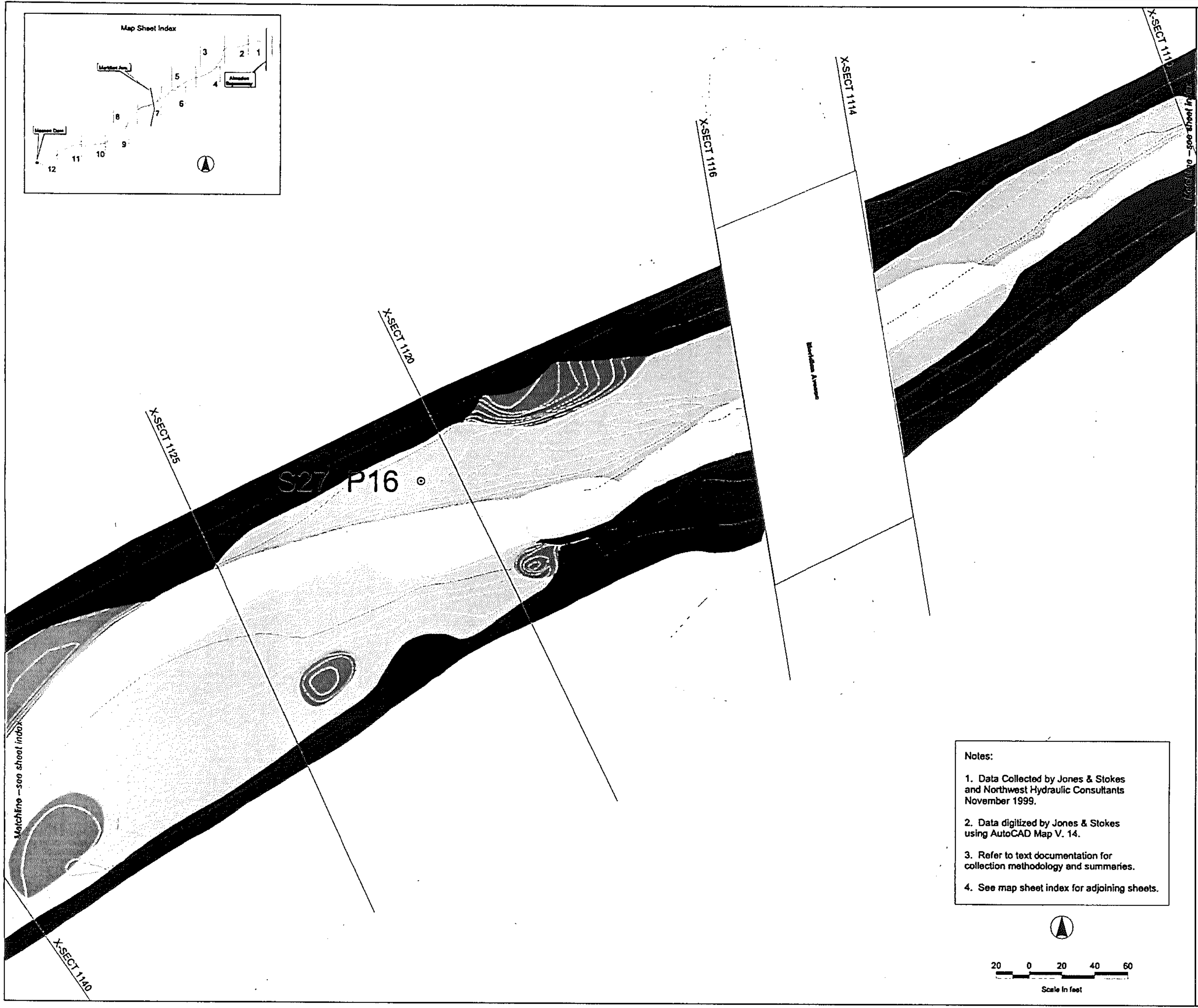
Jones & Stokes

nhc northwest hydraulic consultants

Soil

Sheet 6 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline
Soil
Map

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
■ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

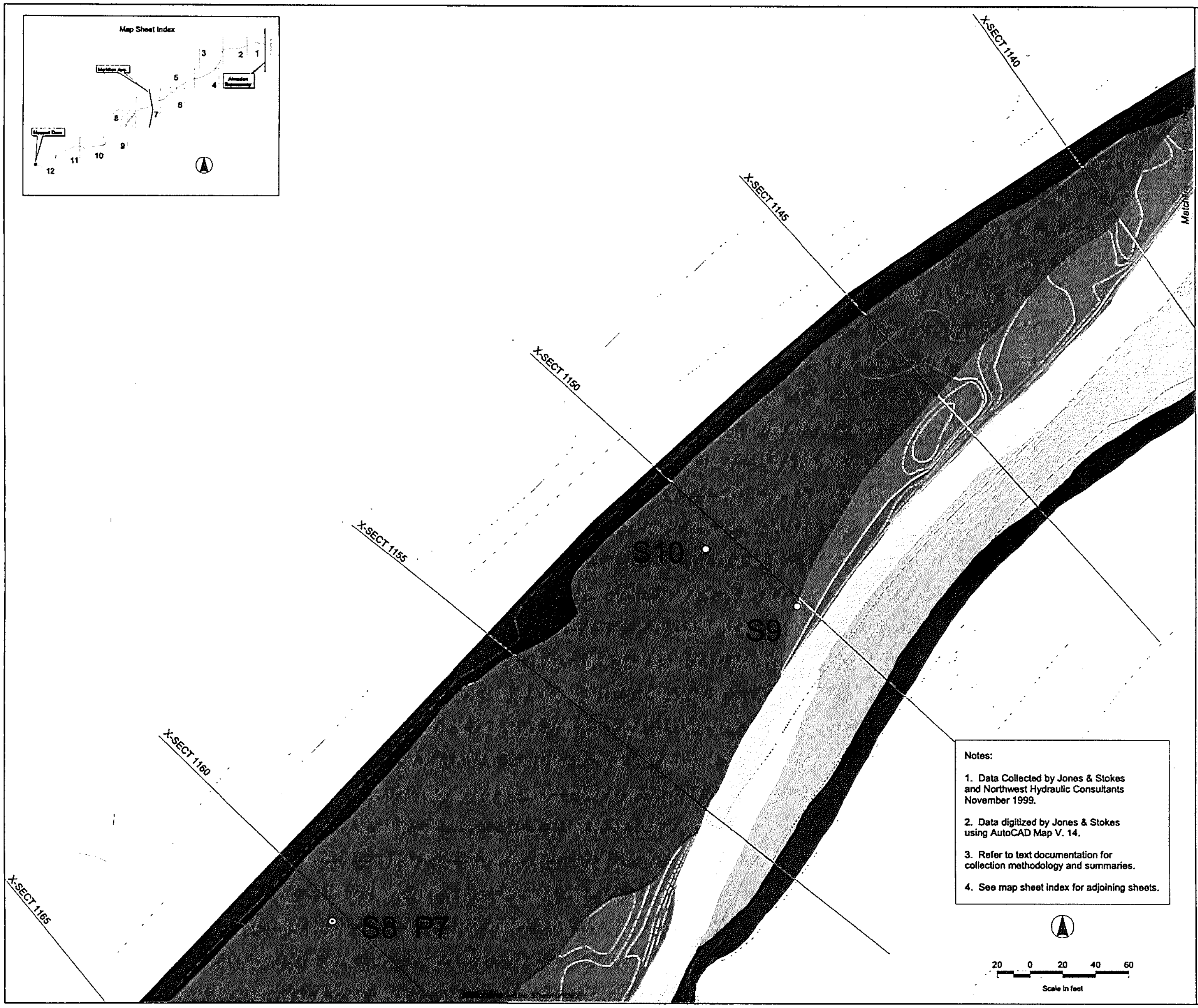
Jones & Stokes

nhc northwest hydraulic consultants

Soil

Sheet 7 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Soil Map

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

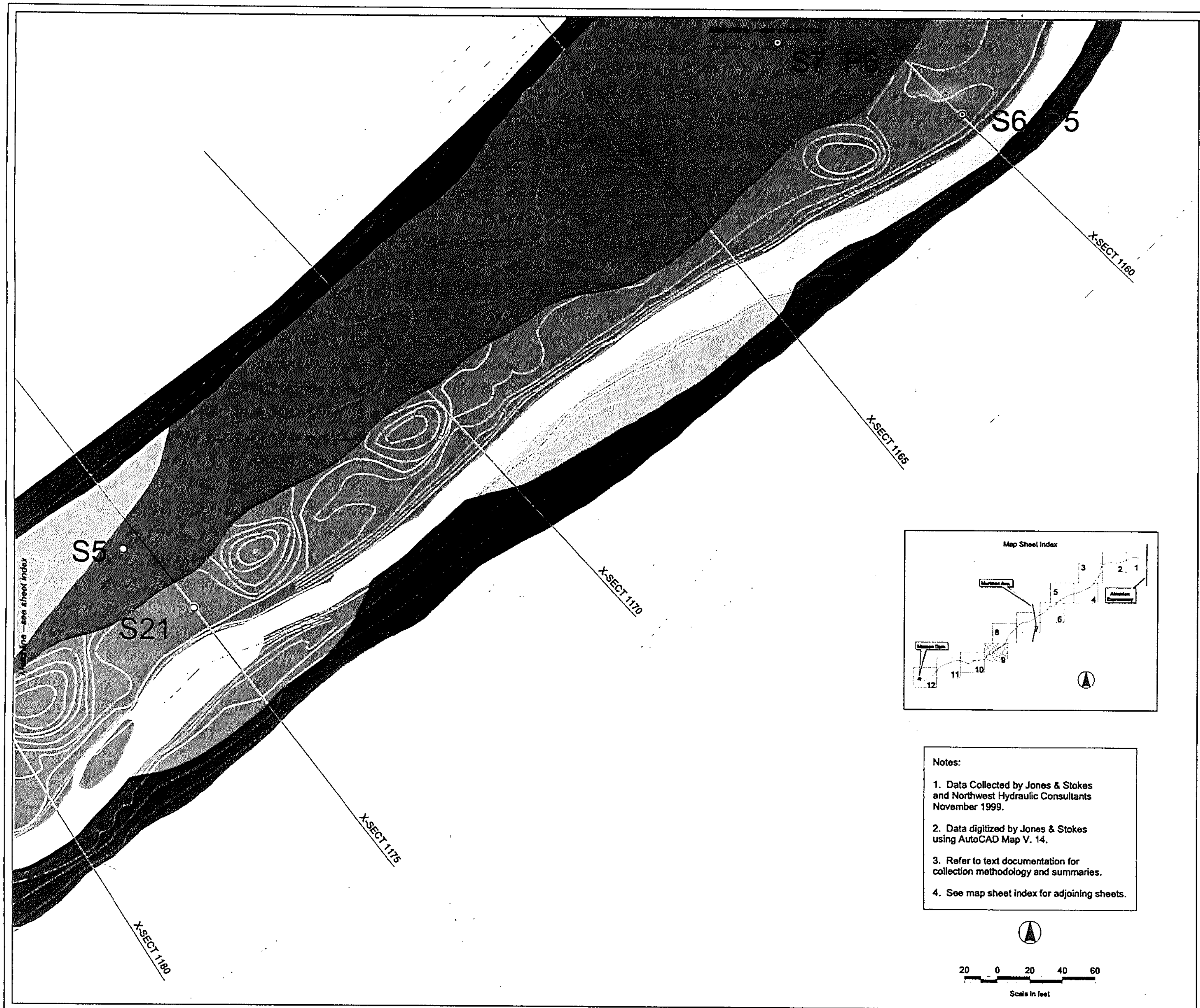
Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes
nhc northwest hydraulic consultants

Soil
Sheet 8 of 12
March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Soil Map

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
▨ Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

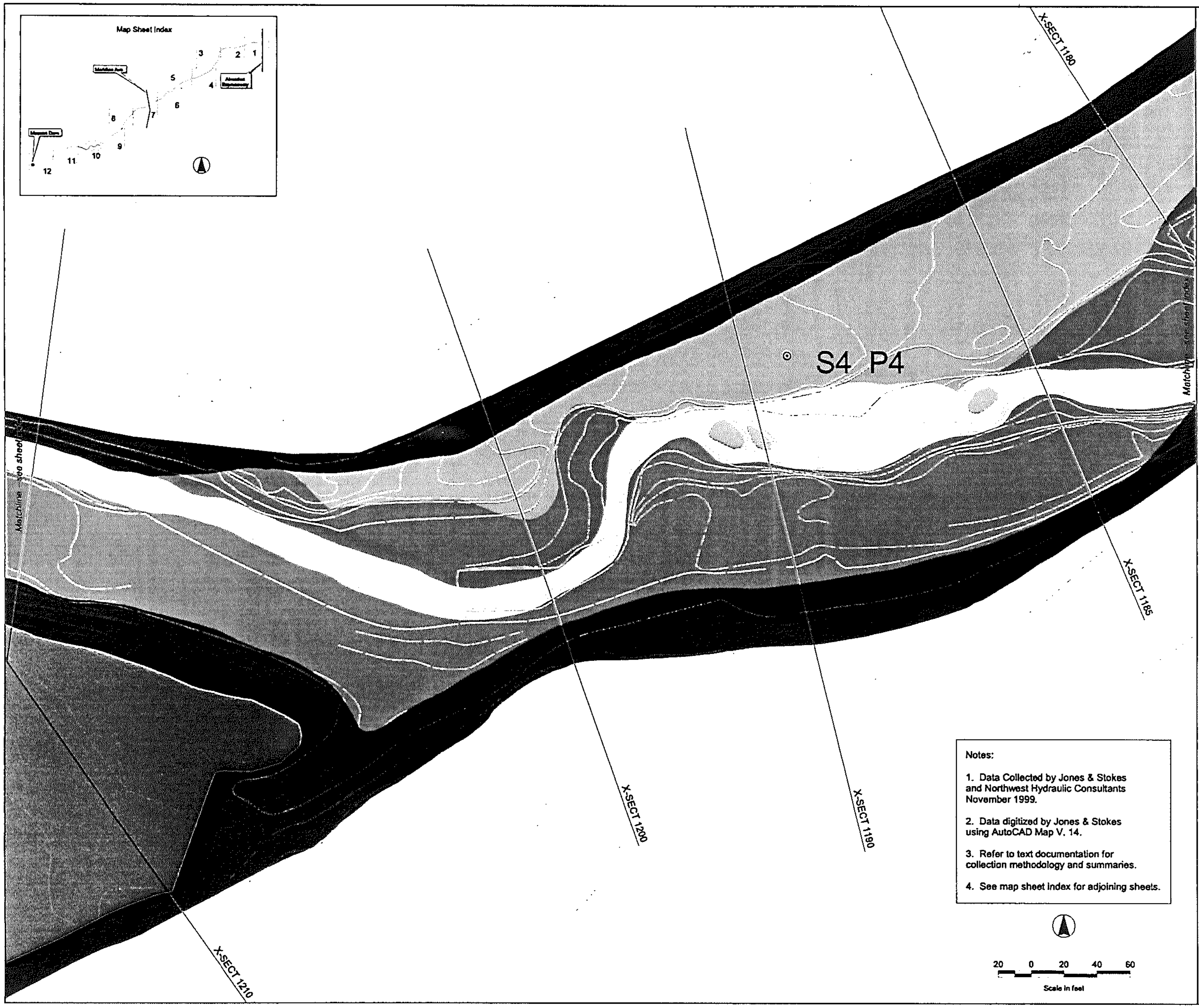
Jones & Stokes

nhc northwest hydraulic consultants

Soil

Sheet 9 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline
Soil
Map

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer
⊙ Pit_piez_loc.shp

Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
▨ Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

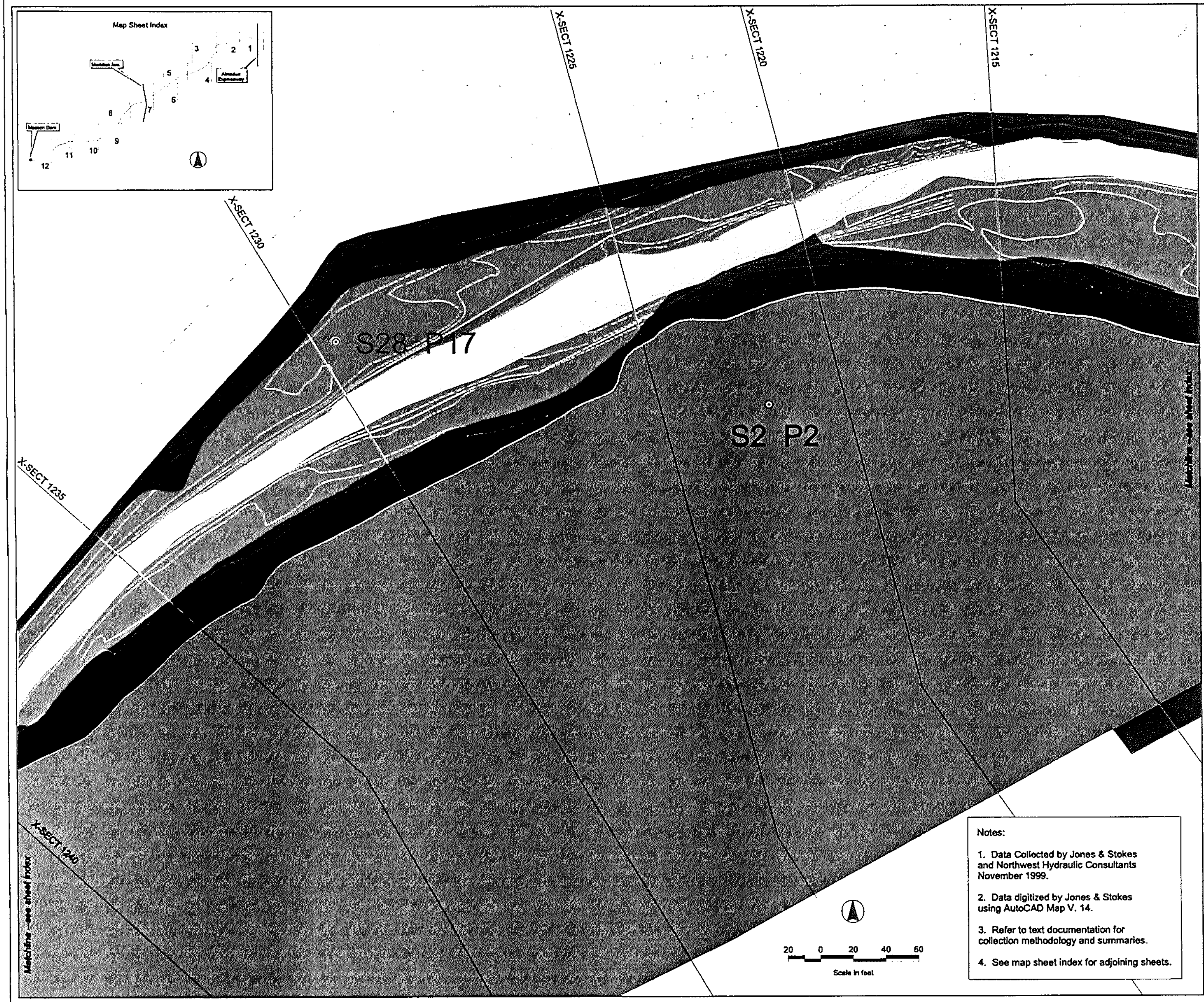
Jones & Stokes

nhc northwest hydraulic consultants

Soil

Sheet 10 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Soil Map

Legend

- ⊙ Soil Pit with Piezometer
- ○ Soil Pit without Piezometer
- ⊙ Pit_piez_loc.shp

Low Flow (November 1999)

- ▨ Soil Map Unit A
- ▨ Soil Map Unit B
- ▨ Soil Map Unit Bd
- ▨ Soil Map Unit C
- Soil Map Unit Cc
- ▨ Soil Map Unit Cd
- ▨ Soil Map Unit D
- ▨ Soil Map Unit Dd
- ■ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

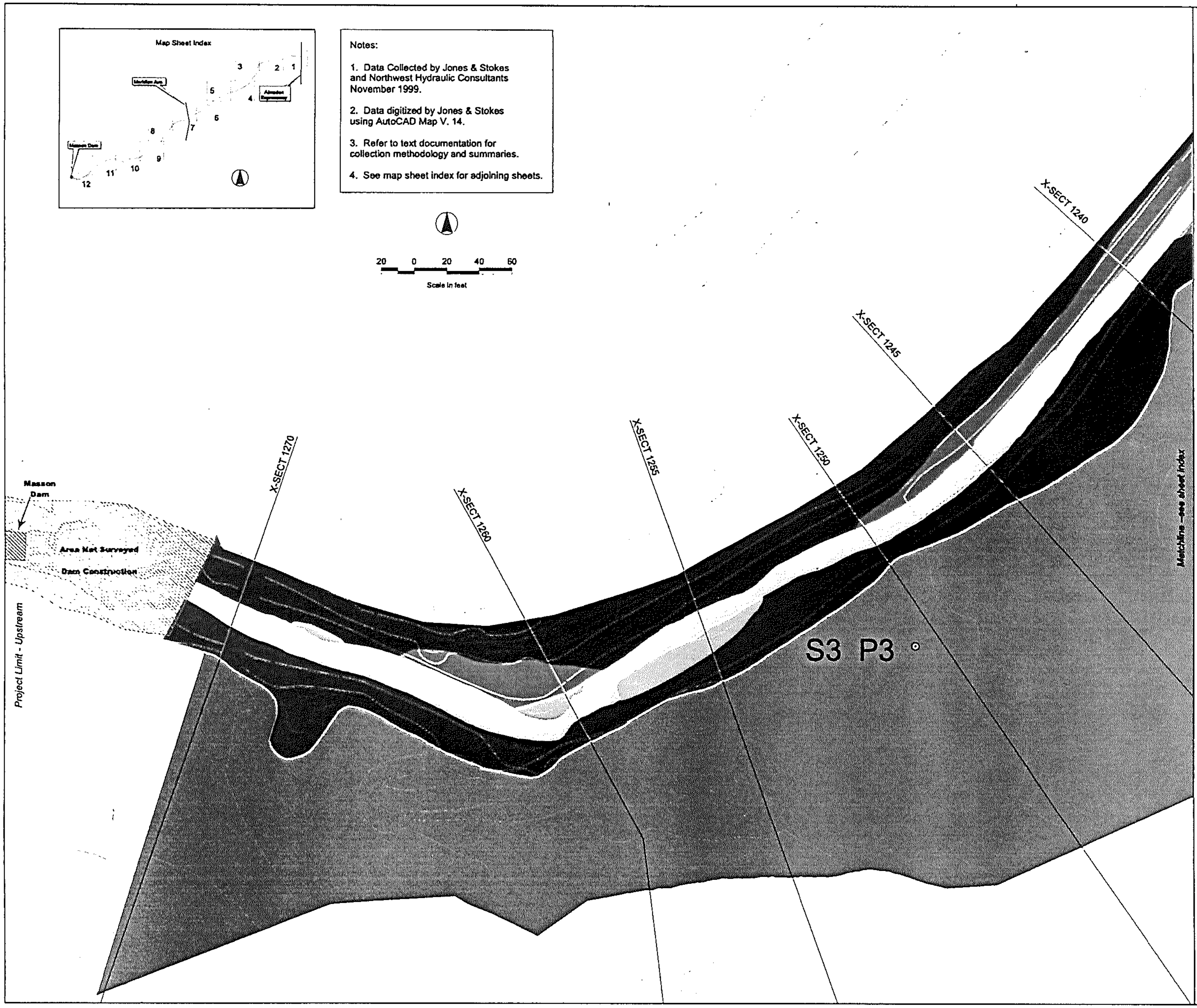
Jones & Stokes
nhc northwest hydraulic consultants

Soil
Sheet 11 of 12
March 23, 2000

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Soil Map



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Legend

⊙ Soil Pit with Piezometer
○ Soil Pit without Piezometer

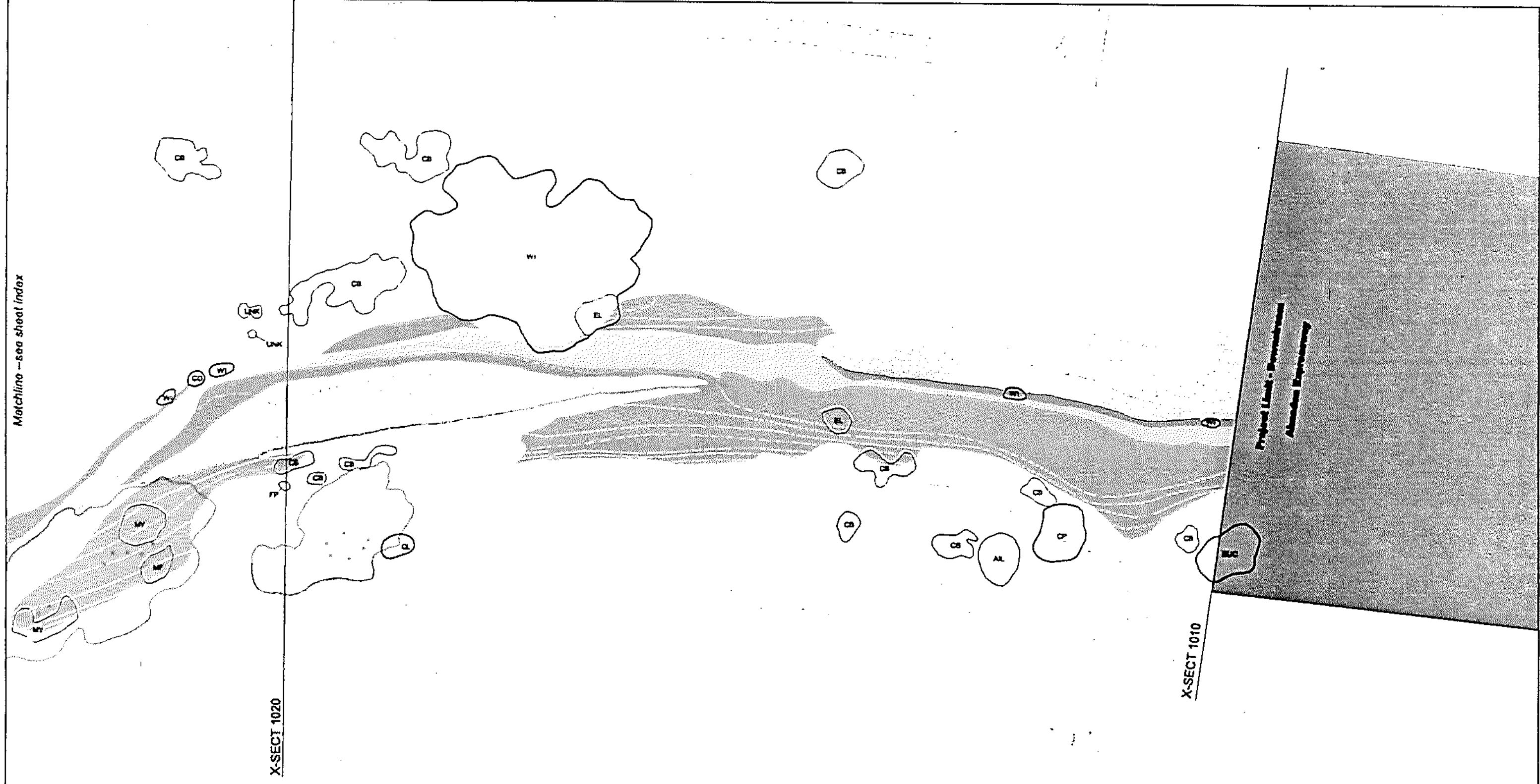
Low Flow (November 1999)

▨ Soil Map Unit A
▨ Soil Map Unit B
▨ Soil Map Unit Bd
▨ Soil Map Unit C
Soil Map Unit Cc
▨ Soil Map Unit Cd
▨ Soil Map Unit D
▨ Soil Map Unit Dd
▨ Soil Map Unit E

Index Contour (5' Interval)
Contour (1' Interval)

Jones & Stokes
nhc northwest hydraulic consultants

Soil
Sheet 12 of 12
March 23, 2000



Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

- ░ Low Flow (November 1999)
- ☐ Unvegetated
- Annual Grassland
- ▒ Mesic Grassland
- ░ Shrub/Vine Scrub
- ▓ Willow Scrub
- Index Contour (5' Interval)
- Contour (1' Interval)
- ☐ Western Sycamore Canopy
- · Western Sycamore Trunks

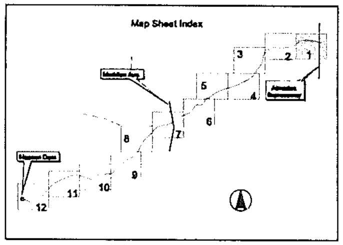
☐ **Tree Canopy**

- AL - White Alder *(Alnus rhombifolia)*
- AS - Oregon Ash *(Fraxinus latifolia)*
- BAY - California Bay *(Umbellularia californica)*
- BU - Buckeye *(Aesculus californica)*
- BW - California Black Walnut *(Juglans californica)*
- CAP - Peruvian Pepper Tree *(Schinus molle)*
- CO - Fremont Cottonwood *(Populus fremontia)*
- CP - Chinese Pistache *(Pistacia chinensis)*
- EUC - Eucalyptus *(Eucalyptus sp.)*
- LO - Live Oak *(Quercus sp.)*
- OL - Olive *(Olea europaea)*
- PE - Almond *(Prunus dulcis)*
- PR - Prunus *(Prunus sp.)*
- VO - Valley Oak *(Quercus lobata)*
- WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**

- AIL - Ailanthus *(Ailanthus altissima)*
- AU - Arbutus *(Arbutus menziesii)*
- BB - Himalayan Blackberry *(Rubus discolor)*
- BR - Scotch Broom *(Cytisus scoparius)*
- CB - Coyote Brush *(Baccharis pilularis)*
- COF - Coffee Berry *(Rhamnus californica)*
- DE - Dead
- EL - Elderberry *(Sambucus mexicana)*
- FP - Fan Palm *(Washingtonia filifera)*
- MF - Mule Fat *(Baccharis salicifolia)*
- MY - Myrtle *(Myrtus communis)*
- PO - Poison Oak *(Toxicodendron diversilobum)*
- PY - Pyracantha *(Pyracantha sp.)*
- RI - River She-oak *(Casuarinas equisetifolia)*
- SI - Silktree *(Albizia julibrissin)*
- TO - Toyon *(Heteromeles arbutifolia)*
- UNK - Unknown
- WR - California Rose *(Rosa californica)*

Map Sheet Index



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

20 0 20 40 60
Scale in feet

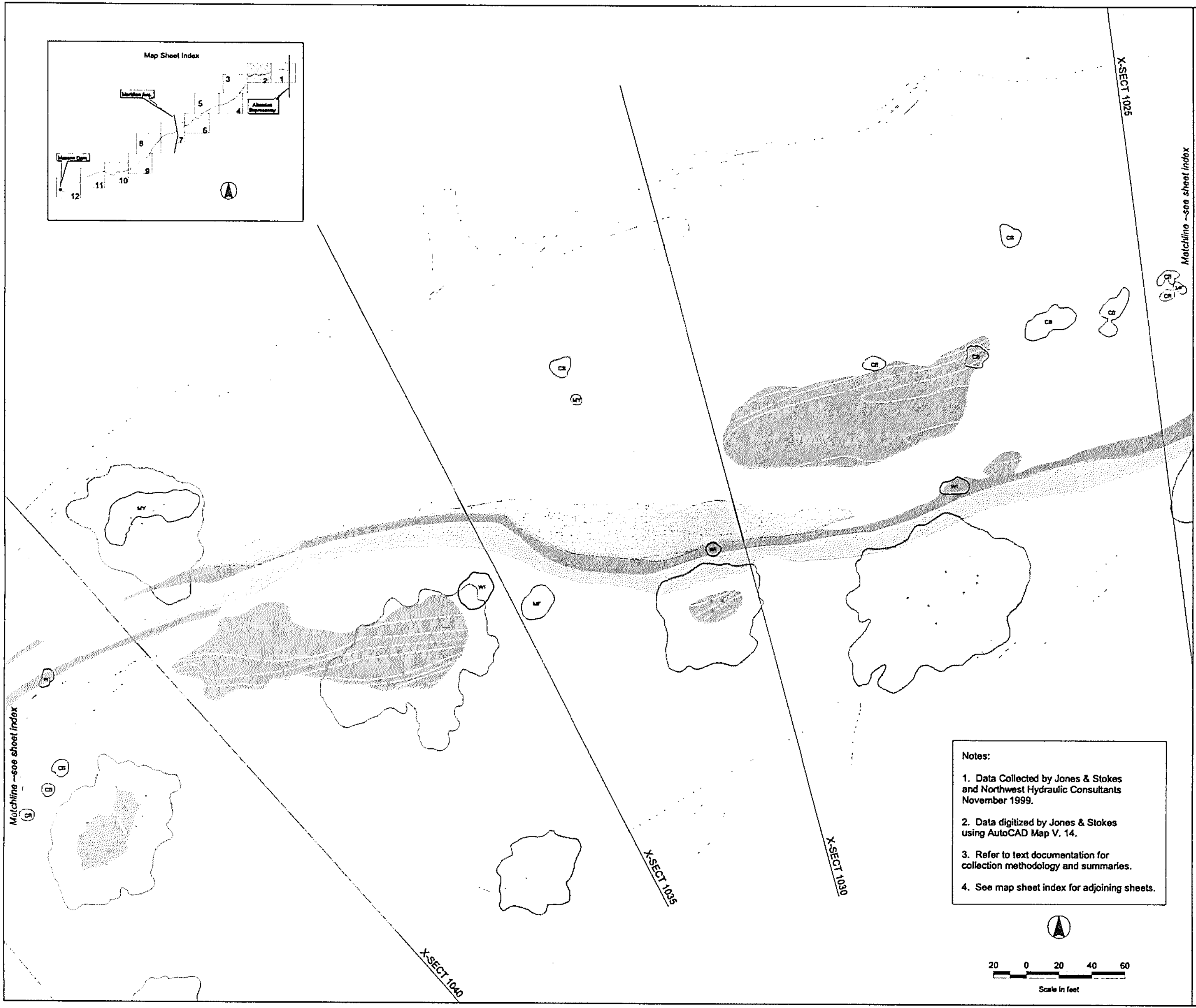
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 1 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

░ Low Flow (November 1999)
Unvegetated
Annual Grassland
▒ Mesic Grassland
░ Shrub/Vine Scrub
▓ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)

☐ Western Sycamore Canopy
• Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

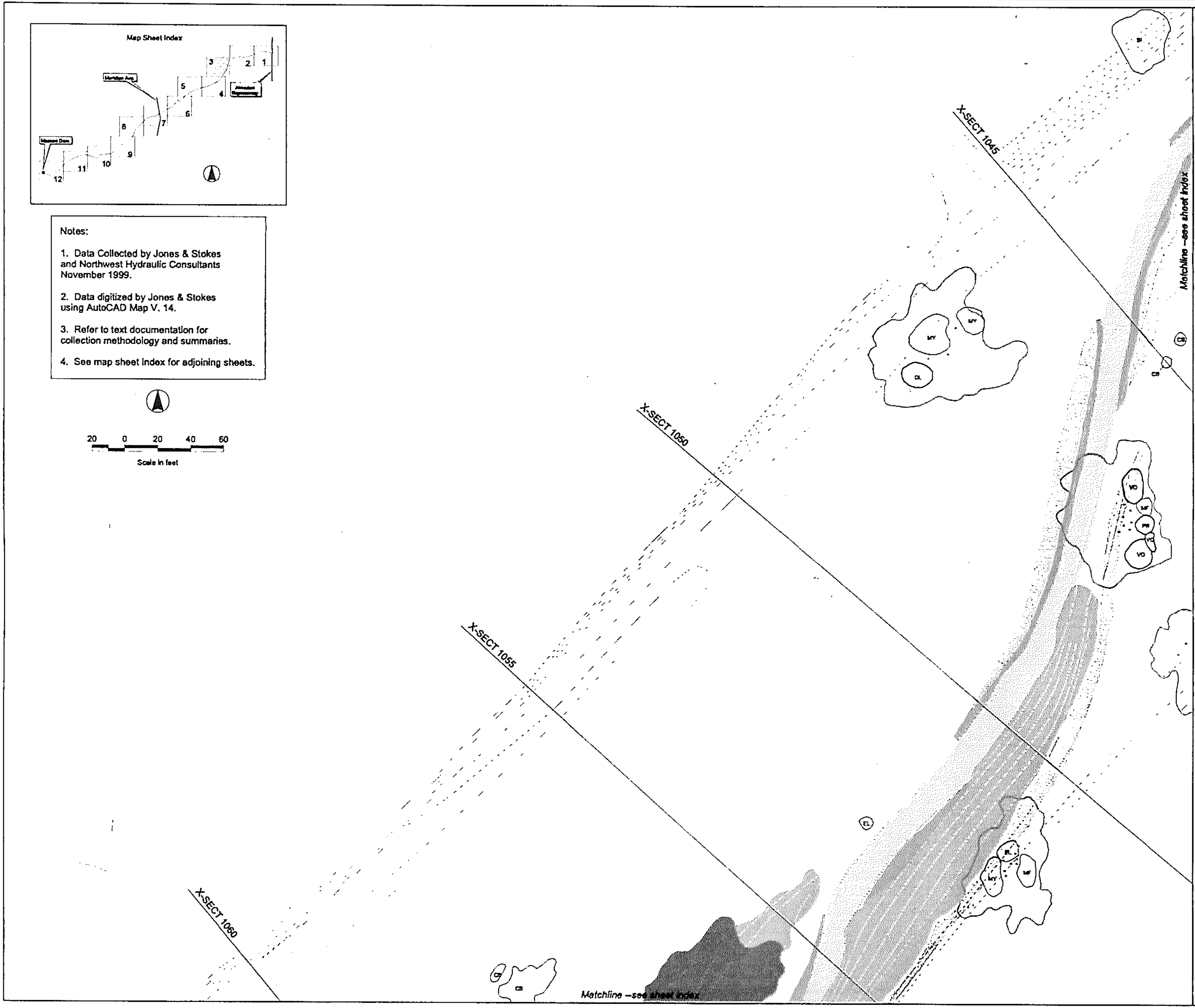
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 2 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

▒ Low Flow (November 1999)
░ Unvegetated
Annual Grassland
▒ Mesic Grassland
▒ Shrub/Vine Scrub
▓ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)

☐ Western Sycamore Canopy
• Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

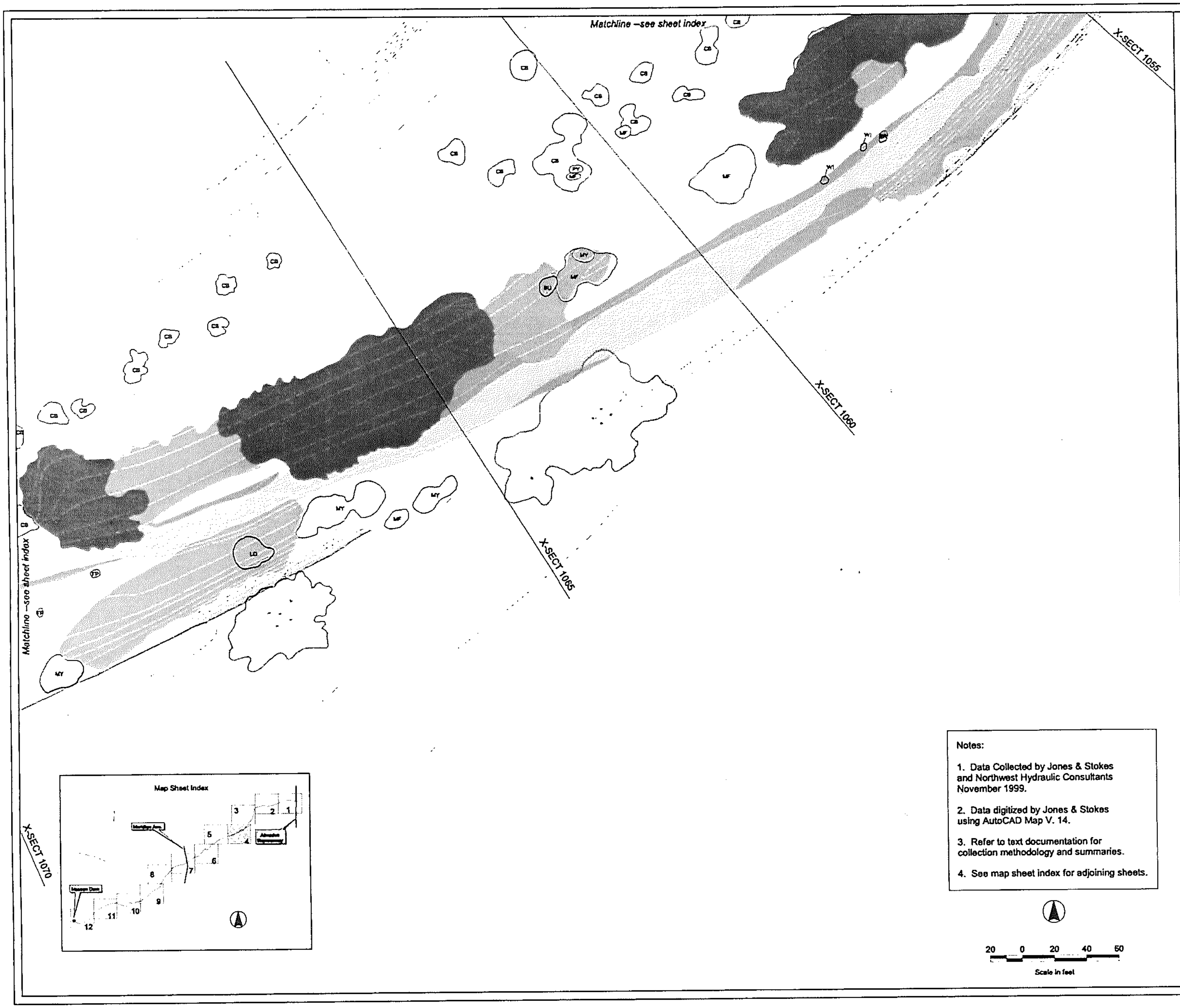
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 3 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

▨ Low Flow (November 1999)
Unvegetated
Annual Grassland
▨ Mesic Grassland
▨ Shrub/Vine Scrub
▨ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)

☐ Western Sycamore Canopy
• Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

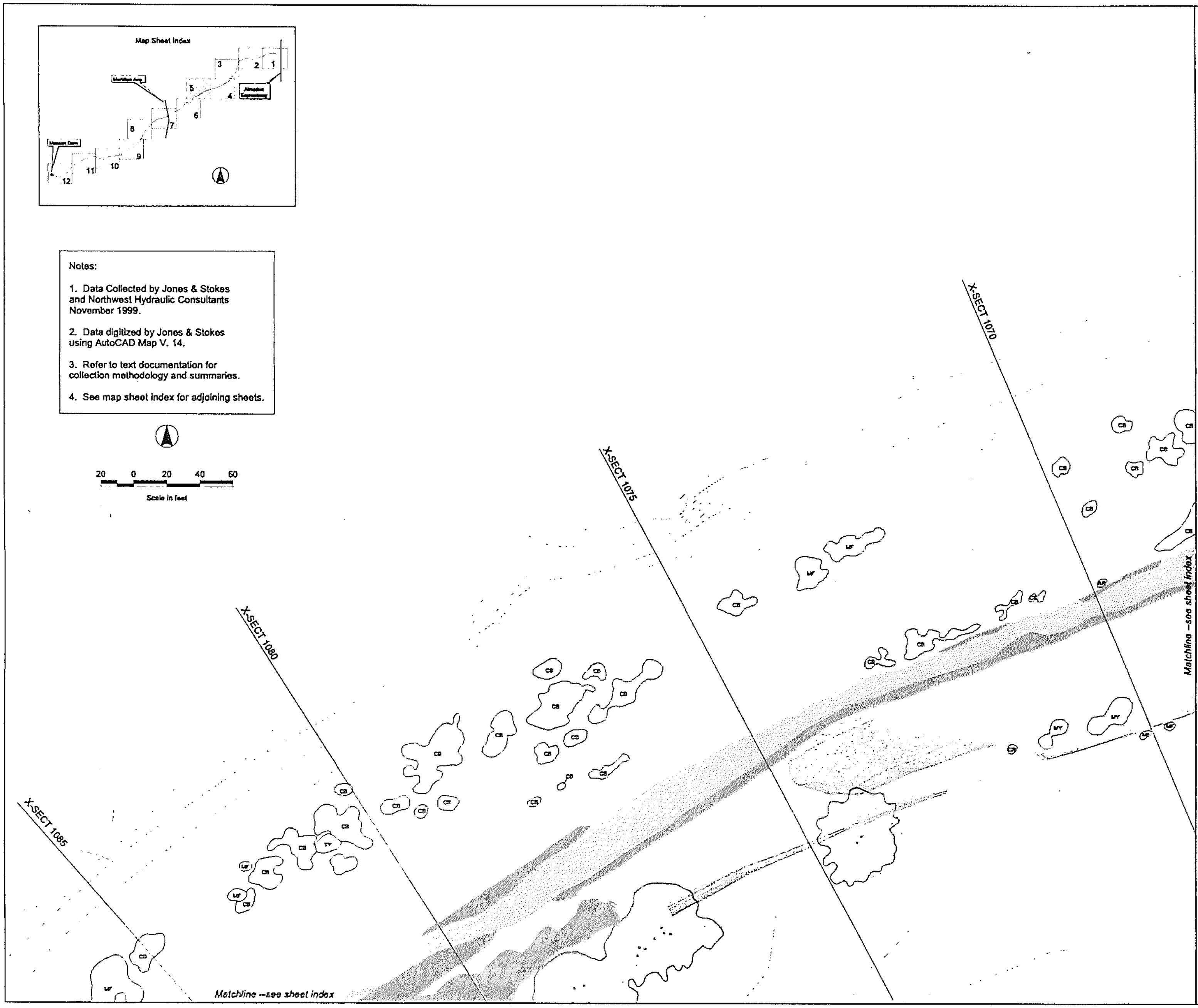
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 4 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

░ Low Flow (November 1999)
Unvegetated
Annual Grassland
▒ Mesic Grassland
▒ Shrub/Vine Scrub
▓ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)

☐ Western Sycamore Canopy
· Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

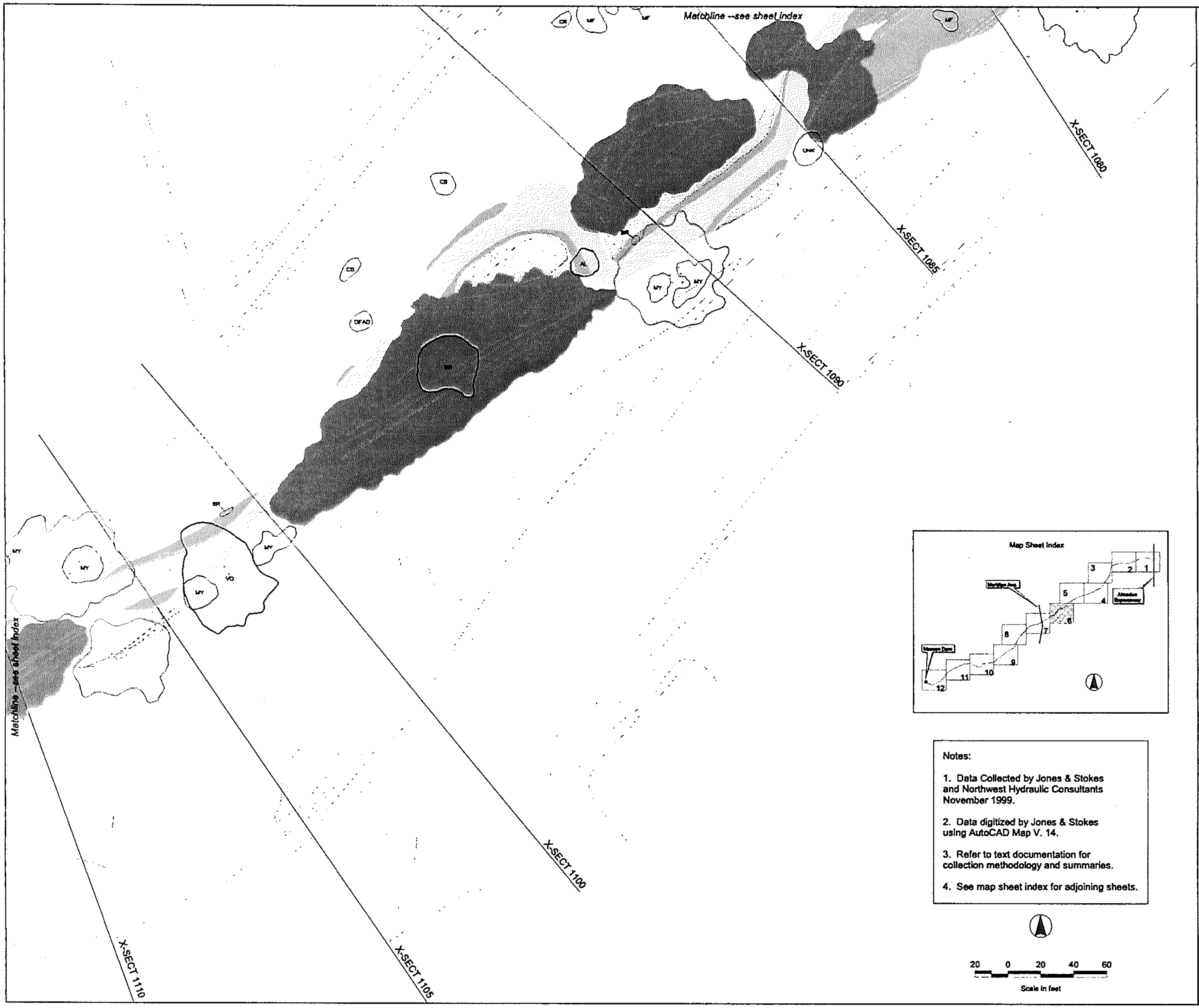
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 5 of 12

March 23, 2000



Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

░ Low Flow (November 1999)
Unvegetated
Annual Grassland
▒ Mesic Grassland
▒ Shrub/Vine Scrub
▓ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)

☐ Western Sycamore Canopy
· Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

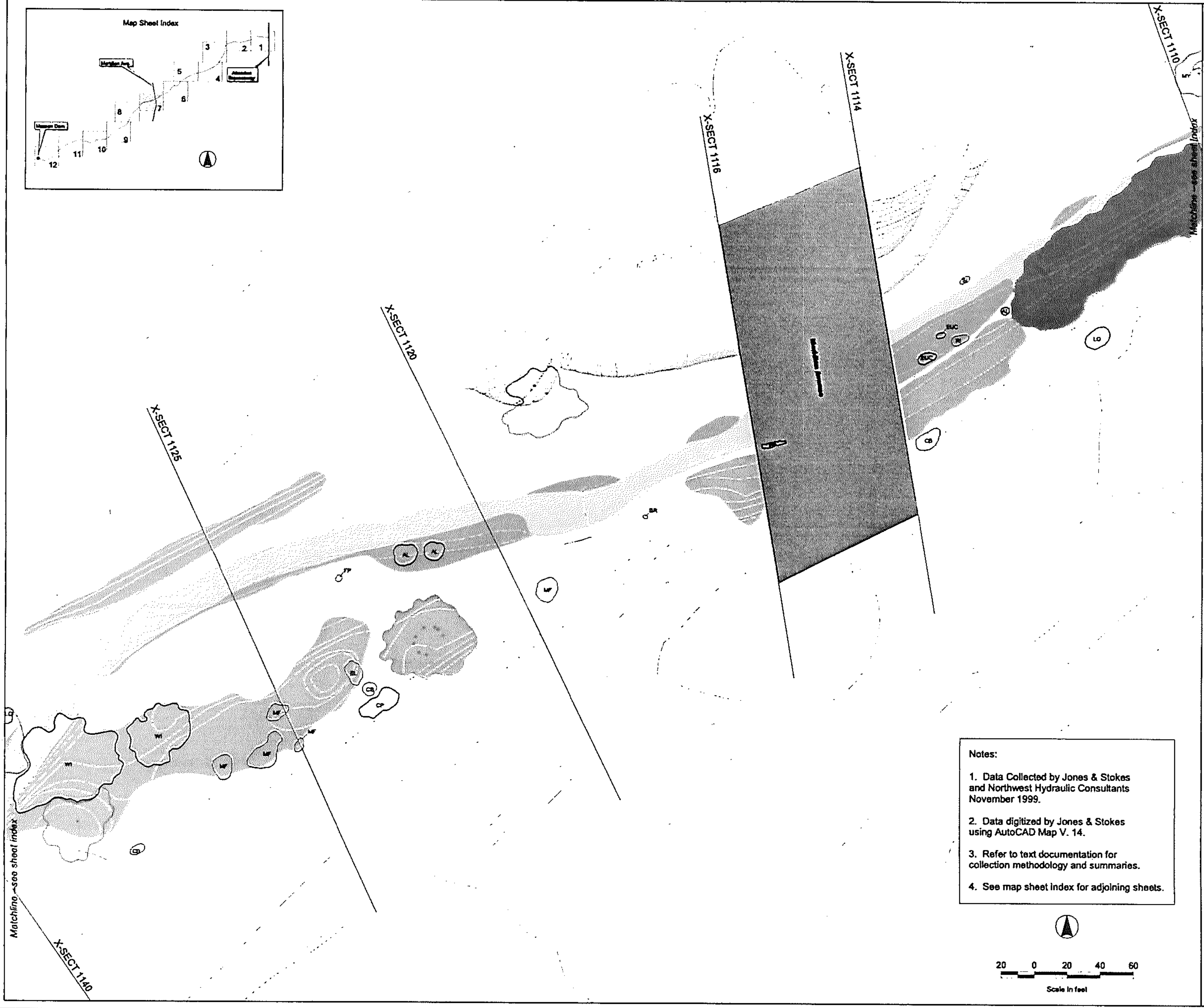
☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Jones & Stokes
nhc northwest hydraulic consultants

Vegetation
Sheet 6 of 12
March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

▨ Low Flow (November 1999)
Unvegetated
Annual Grassland
▨ Mesic Grassland
▨ Shrub/Vine Scrub
■ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)
☐ Western Sycamore Canopy
• Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

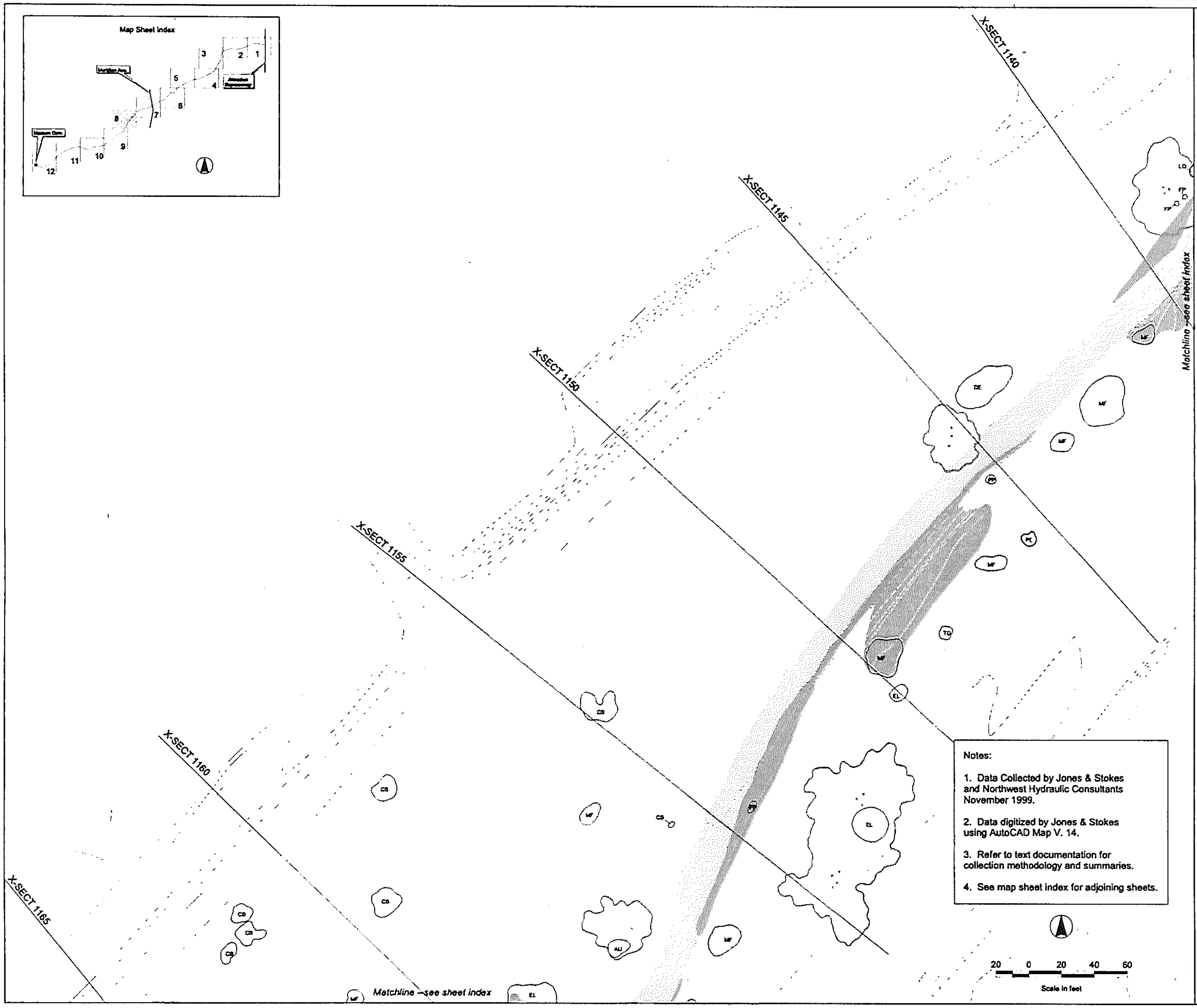
Sheet 7 of 12

March 23, 2000

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.
2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.
3. Refer to text documentation for collection methodology and summaries.
4. See map sheet index for adjoining sheets.

Legend

░ Low Flow (November 1999)
Unvegetated
Annual Grassland
▨ Mesic Grassland
░ Shrub/Vine Scrub
▩ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)

☐ Western Sycamore Canopy
• Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

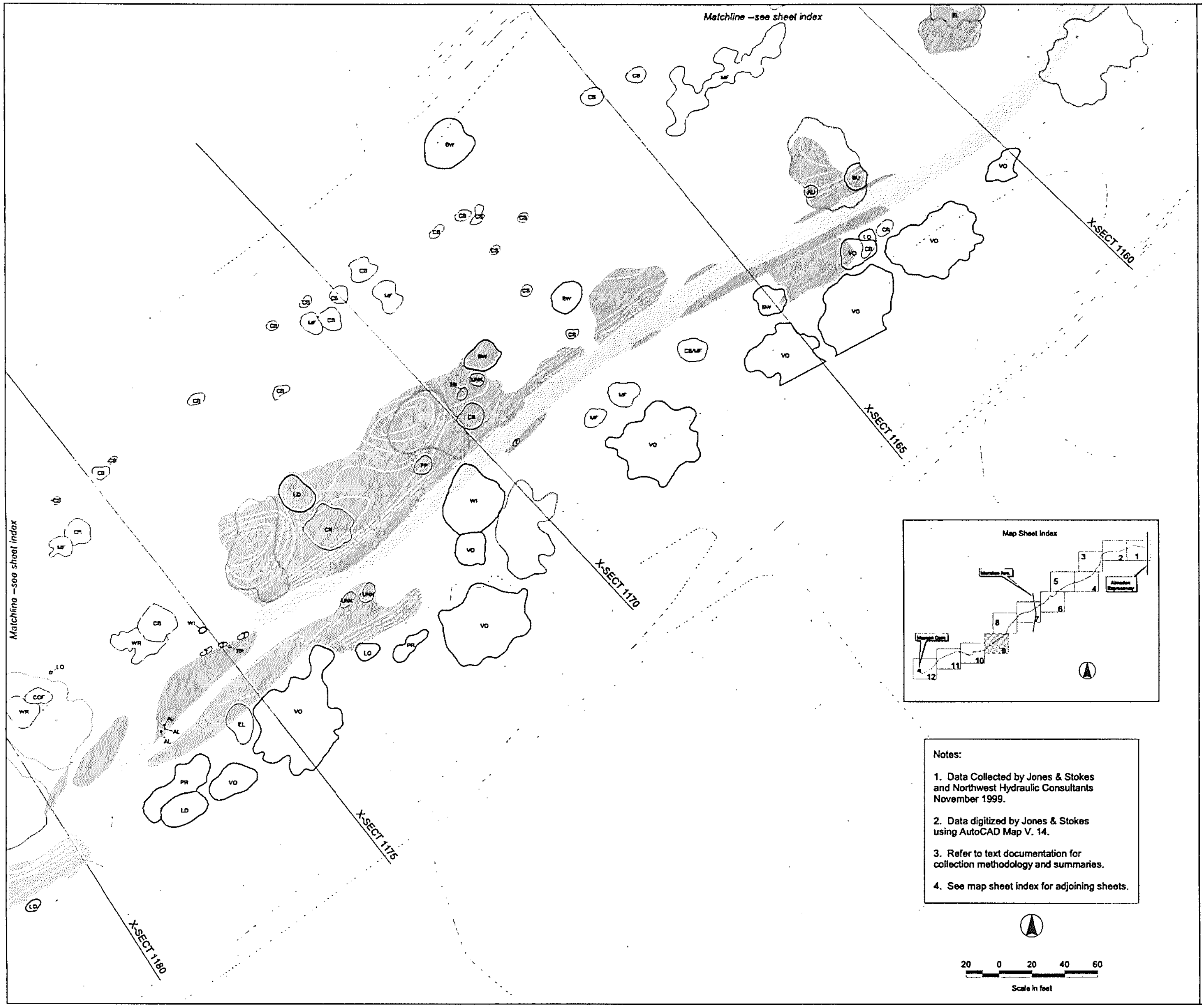
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 8 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

- ░ Low Flow (November 1999)
- ☐ Unvegetated
- Annual Grassland
- ▨ Mesic Grassland
- ░ Shrub/Vine Scrub
- ▓ Willow Scrub
- Index Contour (5' Interval)
- Contour (1' Interval)

- ☐ Western Sycamore Canopy
- • Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Allanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

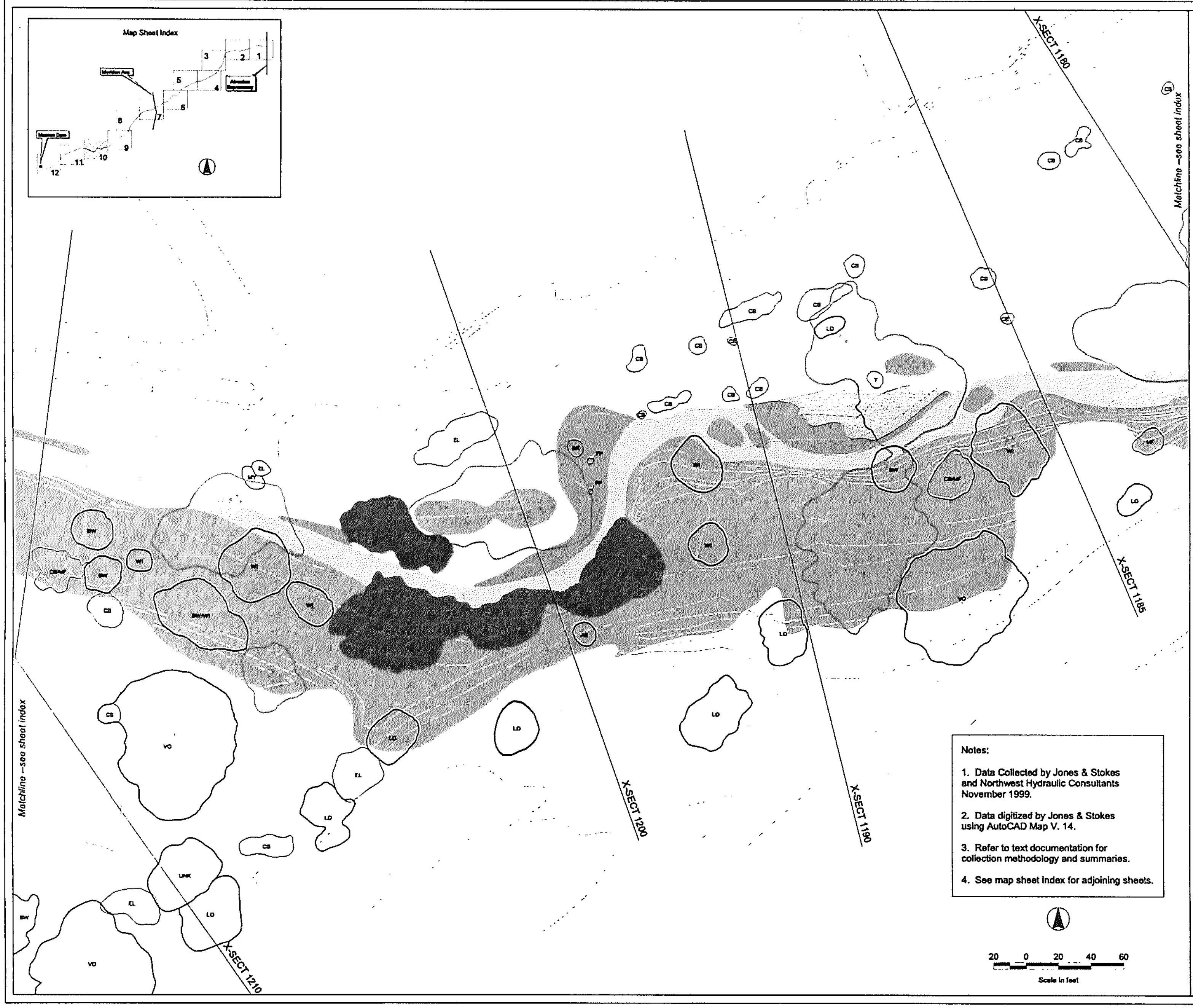
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 9 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

- Low Flow (November 1999)
- Unvegetated
- Annual Grassland
- ▨ Mesic Grassland
- ▨ Shrub/Vine Scrub
- ■ Willow Scrub
- Index Contour (5' Interval)
- Contour (1' Interval)
- ☐ Western Sycamore Canopy
- • Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontii)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

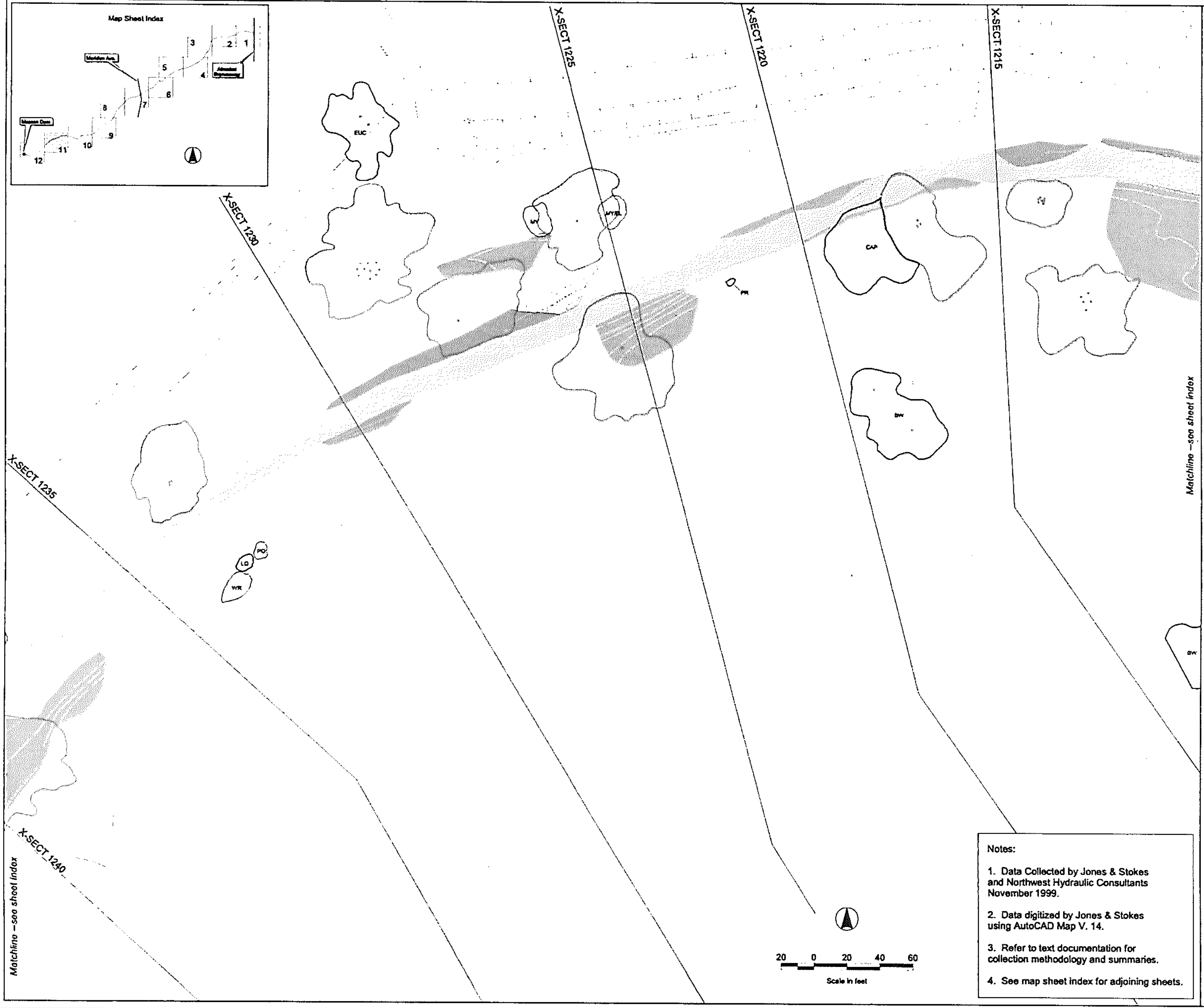
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 10 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

- Low Flow (November 1999)
- Unvegetated
- Annual Grassland
- Mesic Grassland
- Shrub/Vine Scrub
- Willow Scrub
- Index Contour (5' Interval)
- Contour (1' Interval)
- Western Sycamore Canopy
- Western Sycamore Trunks

Tree Canopy

AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

Shrub Canopy

AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

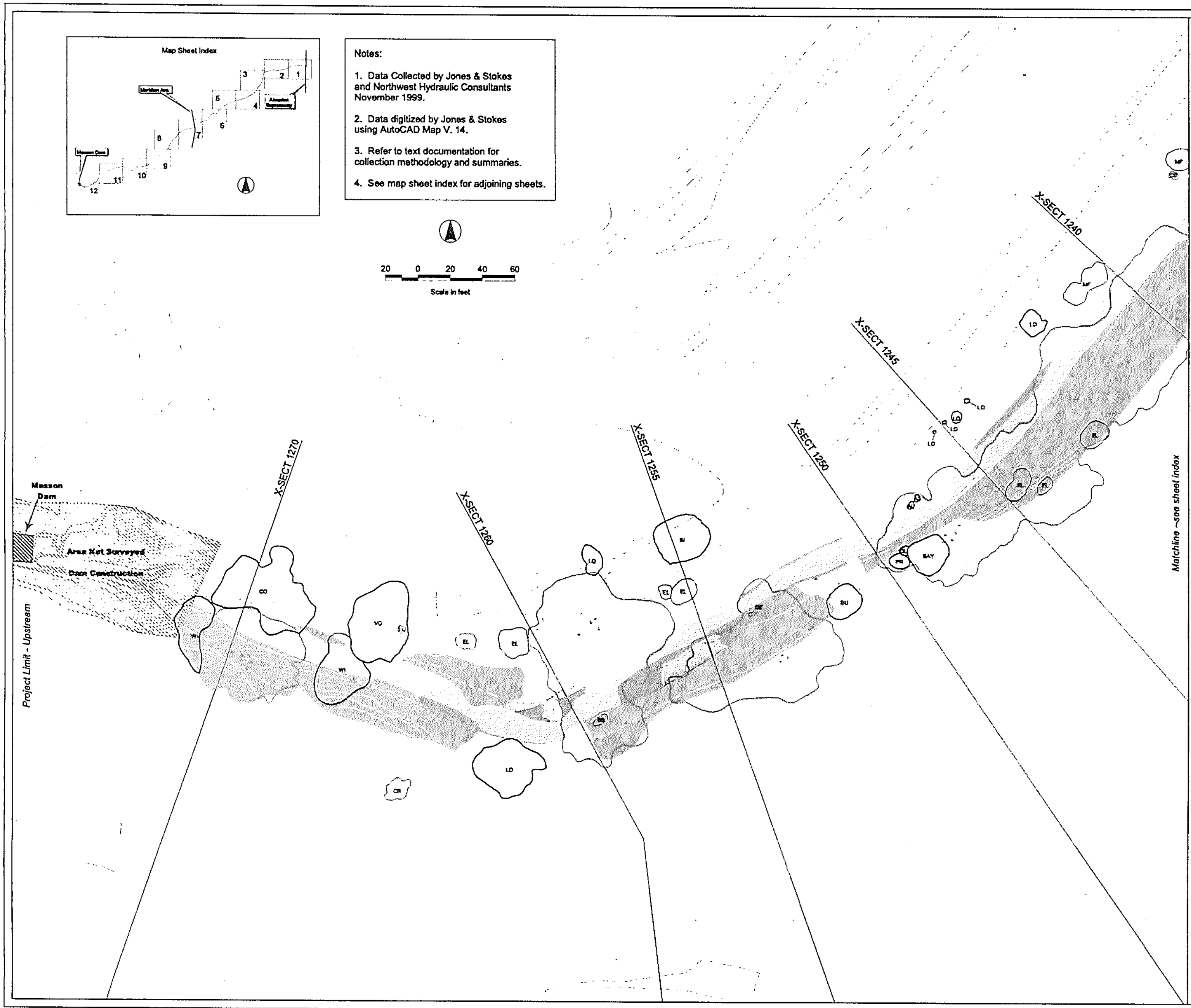
Jones & Stokes

nhc northwest hydraulic consultants

Vegetation

Sheet 11 of 12

March 23, 2000



Notes:

1. Data Collected by Jones & Stokes and Northwest Hydraulic Consultants November 1999.

2. Data digitized by Jones & Stokes using AutoCAD Map V. 14.

3. Refer to text documentation for collection methodology and summaries.

4. See map sheet index for adjoining sheets.

Guadalupe Creek Mitigation Project

Santa Clara Valley Water District

Baseline Vegetation Map

Legend

Low Flow (November 1999)
Unvegetated
Annual Grassland
▨ Mesic Grassland
▨ Shrub/Vine Scrub
▨ Willow Scrub
Index Contour (5' Interval)
Contour (1' Interval)

☐ Western Sycamore Canopy
• Western Sycamore Trunks

☐ **Tree Canopy**
AL - White Alder *(Alnus rhombifolia)*
AS - Oregon Ash *(Fraxinus latifolia)*
BAY - California Bay *(Umbellularia californica)*
BU - Buckeye *(Aesculus californica)*
BW - California Black Walnut *(Juglans californica)*
CAP - Peruvian Pepper Tree *(Schinus molle)*
CO - Fremont Cottonwood *(Populus fremontia)*
CP - Chinese Pistache *(Pistacia chinensis)*
EUC - Eucalyptus *(Eucalyptus sp.)*
LO - Live Oak *(Quercus sp.)*
OL - Olive *(Olea europaea)*
PE - Almond *(Prunus dulcis)*
PR - Prunus *(Prunus sp.)*
VO - Valley Oak *(Quercus lobata)*
WI - Willow *(Salix sp.)*

☐ **Shrub Canopy**
AIL - Ailanthus *(Ailanthus altissima)*
AU - Arbutus *(Arbutus menziesii)*
BB - Himalayan Blackberry *(Rubus discolor)*
BR - Scotch Broom *(Cytisus scoparius)*
CB - Coyote Brush *(Baccharis pilularis)*
COF - Coffee Berry *(Rhamnus californica)*
DE - Dead
EL - Elderberry *(Sambucus mexicana)*
FP - Fan Palm *(Washingtonia filifera)*
MF - Mule Fat *(Baccharis salicifolia)*
MY - Myrtle *(Myrtus communis)*
PO - Poison Oak *(Toxicodendron diversilobum)*
PY - Pyracantha *(Pyracantha sp.)*
RI - River She-oak *(Casuarinas equisetifolia)*
SI - Silktree *(Albizia julibrissin)*
TO - Toyon *(Heteromeles arbutifolia)*
UNK - Unknown
WR - California Rose *(Rosa californica)*

Jones & Stokes

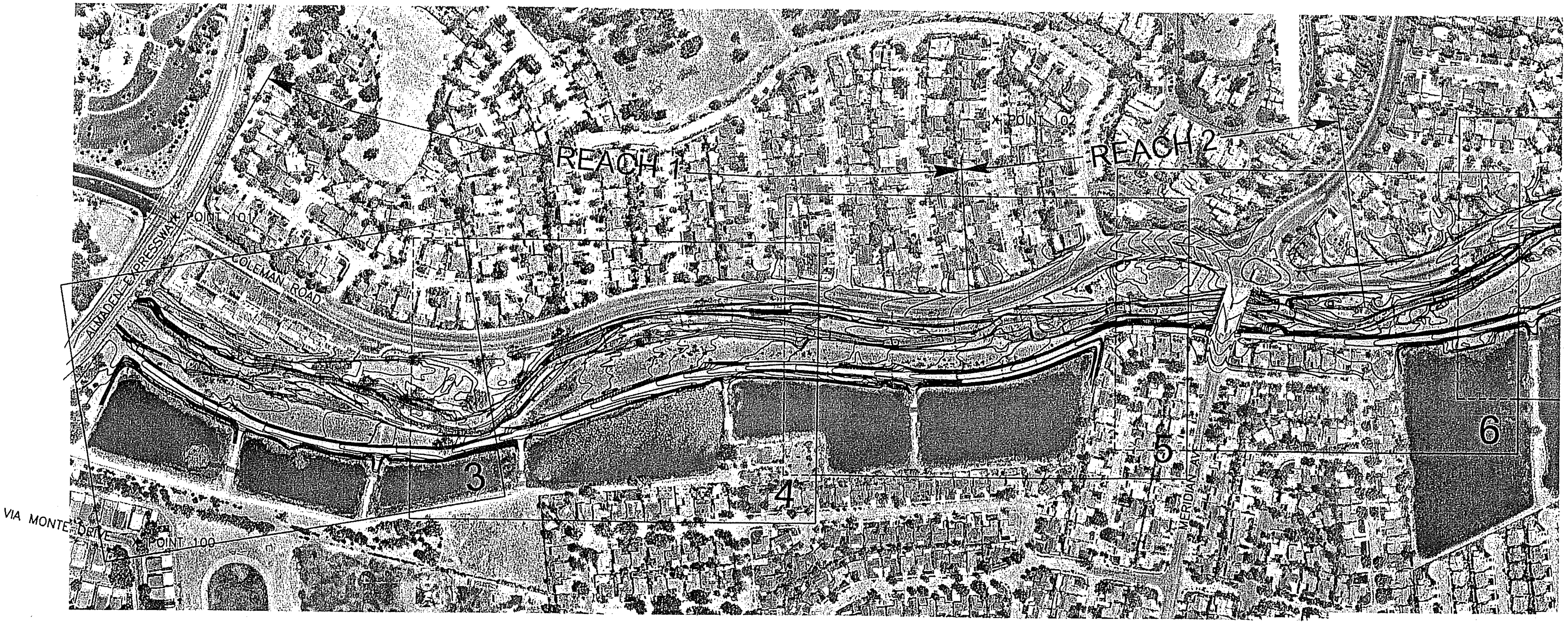
nhc northwest hydraulic consultants

Vegetation

Sheet 12 of 12

March 23, 2000

Appendix B. Ground Survey Cross Section Locations



✳ POINT 107

CONTROL LISTING FOR TOPOGRAPHIC AND CROSS SECTION MAPPING
PROVIDED BY SANTA CLARA VALLEY WATER DISTRICT (PROJECT GUADALUPE CREEK)

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
100	1914828.55	6161008.08	198.34	BRASS PIN MONUMENT
101	1913755.25	6161444.93	202.20	FD. PK NAIL
102	1912047.83	6159050.17	217.07	SET PK NAIL
103	1911230.07	6156990.53	239.08	SET MAG NAIL
104	1909617.25	6154716.49	253.44	SET MAG NAIL
105	1911161.71	6154001.72	273.31	SET LARGE NAIL
106	1912503.32	6156235.17	240.01	SET MAG NAIL
107	1913681.29	6158117.12	215.64	SET MAG NAIL

HORIZONTAL DATUM: NAD83
VERTICAL DATUM: NGVD29

ALL NHC CONTROL (POINTS 2001 TO 2027) ARE ALUMINUM CAPS OVER 1/2" REBAR
EXCEPT CONTROL POINT 2013 WHICH IS AN AERIAL CROSS
HORIZONTAL COORDINATES FOR CONTROL POINTS WERE PROVIDED
BY SCVWD AND ARE REFERENCED TO THE CONTROL LISTING ABOVE
THE LOCATION (NAD83 COORDINATES), AND ELEVATION (NGVD29) ARE PROVIDED ON SHEETS 3-9

DATE OF PHOTOGRAPHY 8/17/1999 BY AIR FLIGHT SERVICES, SANTA CLARA, CA
TOPOGRAPHIC MAPPING FURNISHED BY AELYTEK, INC, SUNNYVALE CA

Designed by:	Date: February 7, 2000	File name:	Project No.:	Drawing Index No.:
Dwn by:	Ckd by:	Revised by:	PCP:	

Revisions:	Description	Date	Approved

DRAFT

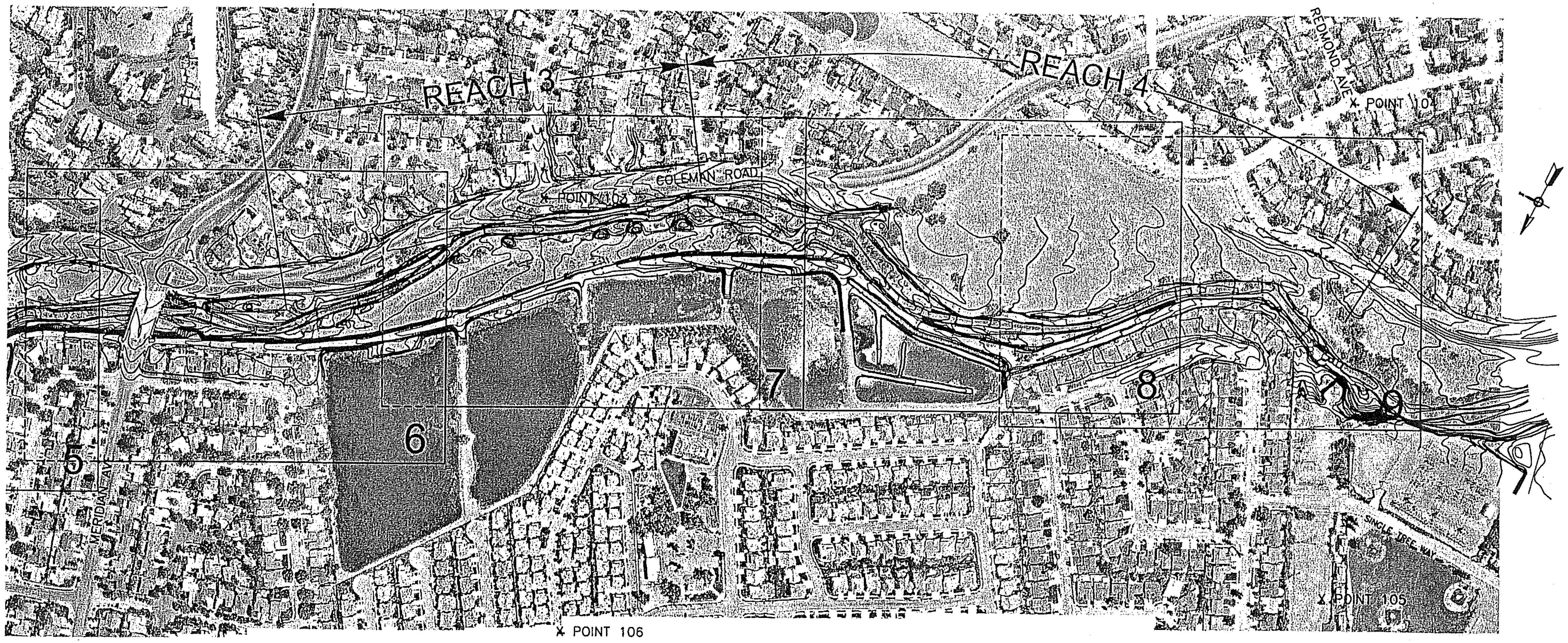
Prepared for:
JONES AND STOKES ASSOCIATES
2600 V STREET
SACRAMENTO, CA 95818
916 737-3000

nhc
northwest hydraulic consultants inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691
(916) 371-7400

GUADALUPE CREEK
SANTA CLARA COUNTY, CA
GROUND SURVEY CROSS SECTION LOCATIONS
NOVEMBER 18- 24 SURVEY

Sheet reference number

Sheet 1 of 9



MAP LEGEND

E 6 155 400 / N 1 910 200 +	NAD83 ZONE 3 GRID TICKS	⑤	GRAVEL BAR PEBBLE COUNT LOCATION
96+00	STREAM DISTANCE FROM MOUTH (HUNDREDS OF FEET)	▷ NHC 2027 N 1910434.94 E 6154502.45 ELEV 256.81	CROSS SECTION SURVEY CONTROL LOCATION
S8	SOIL TEST PIT LOCATION	X-SECT 1270 ⊕——⊕	GROUND SURVEY CROSS SECTION LOCATION
P8	PIEZOMETER WELL LOCATION		

Sheet reference number
Sheet 2 of 9

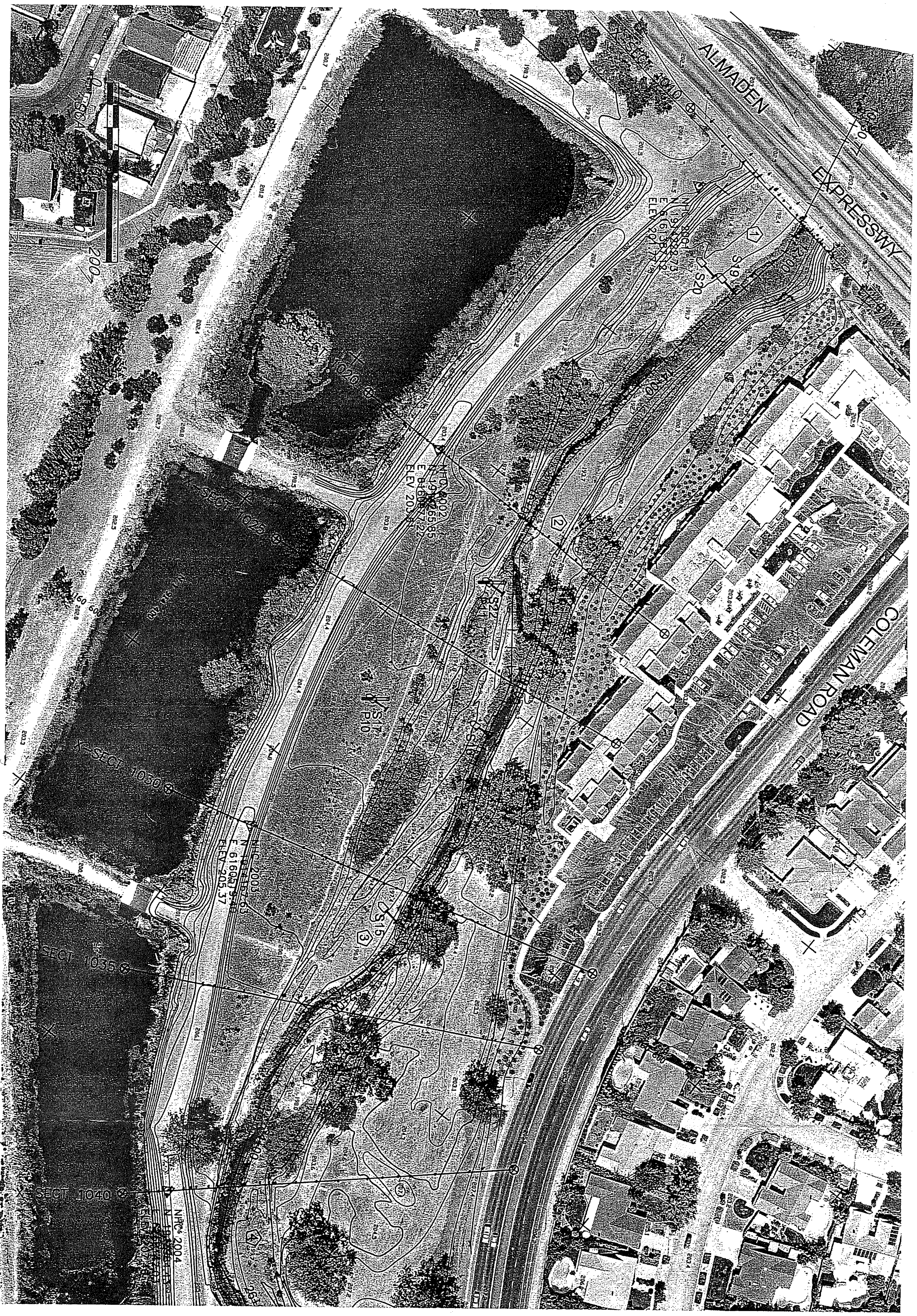
GUADALUPE CREEK
SANTA CLARA COUNTY, CA
GROUND SURVEY CROSS SECTION LOCATIONS
NOVEMBER 18- 24 SURVEY

Prepared for:
JONES AND STOKES ASSOCIATES
2600 V STREET
SACRAMENTO, CA 95818
916 737-3000

nhc northwest hydraulic consultants inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691
(916) 371-7400

DRAFT

Designed by:	Date: February 7, 2000	File name:	Project No.:	Drawing Index No.:	
Dwn by: Ckd by:	Revised by:	PCP:			
Revisions:		Description		Date	Approved



Sheet reference number

Sheet 3 of 9

GUADALUPE CREEK
SANTA CLARA COUNTY, CA

GROUND SURVEY CROSS SECTION LOCATIONS

NOVEMBER 18- 24 SURVEY

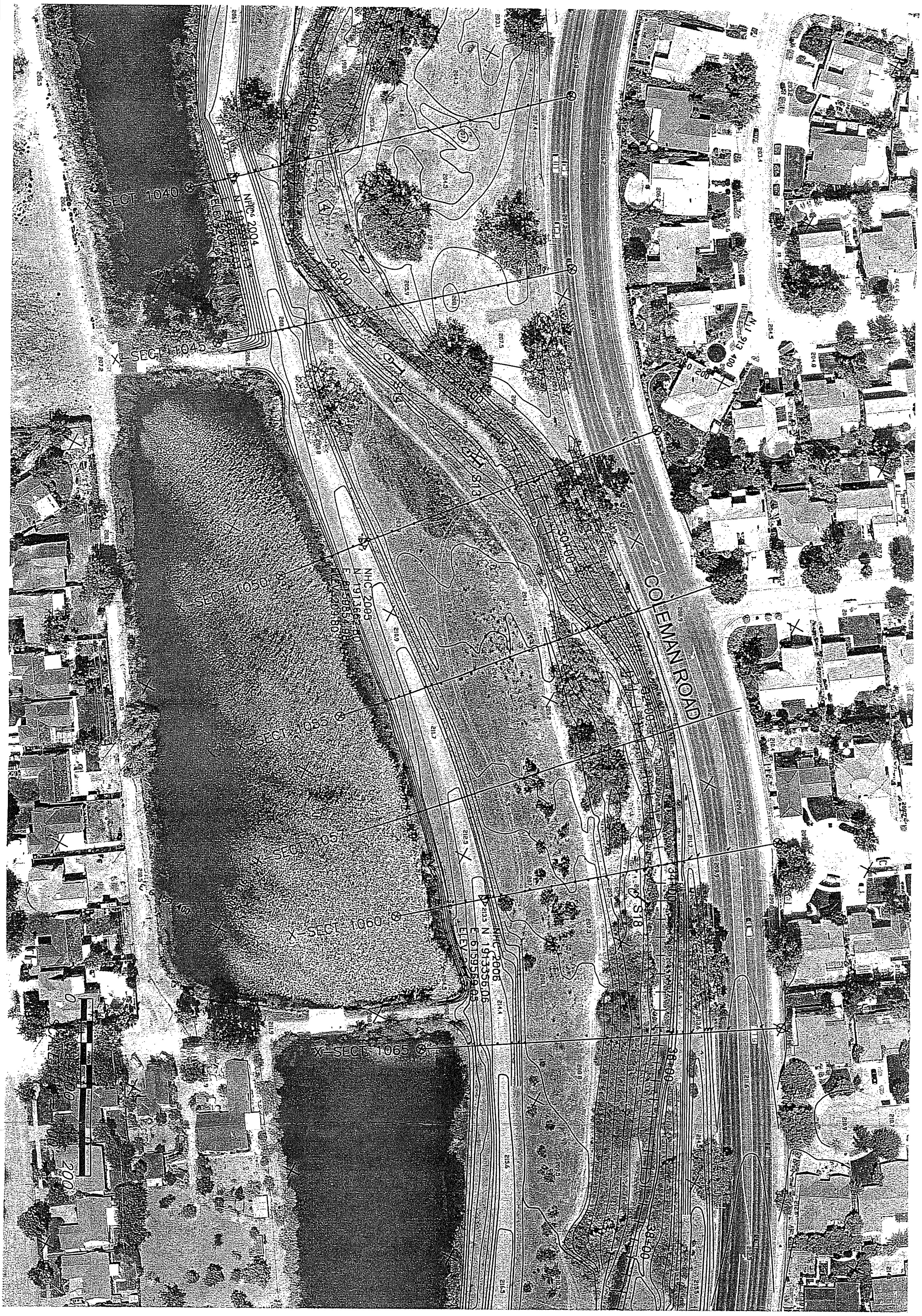
Prepared for:
JONES AND STOKES ASSOCIATES
2600 V STREET
SACRAMENTO, CA 95818
916 737-3000

nhc northwest hydraulic consultants inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691
(916) 371-7400

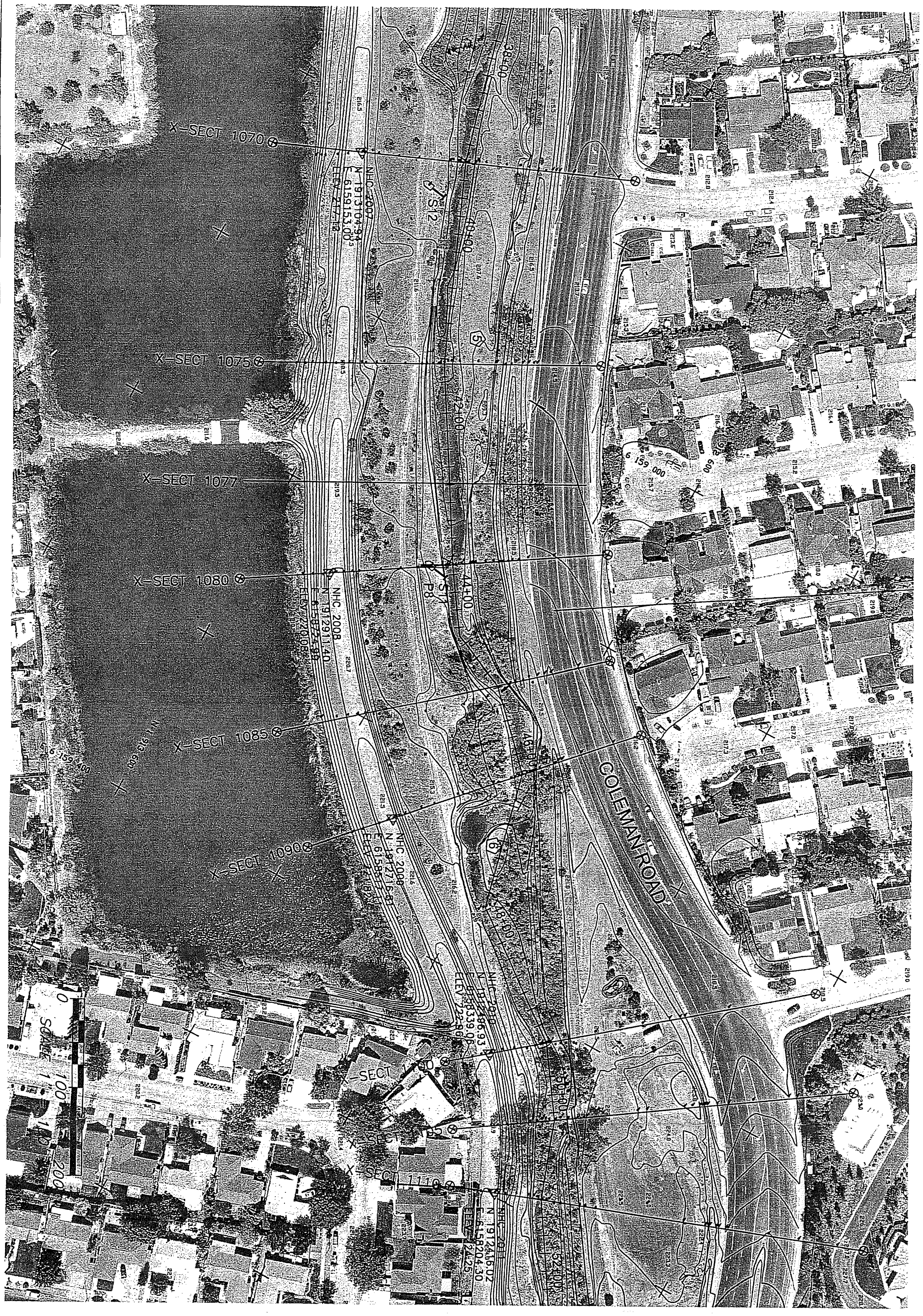
DRAFT

Designed by:		Date: February 7, 2000	File name:	Project No.:	Drawing Index No.:
Dwn by:	Ckd by:	Revised by:	PCP:		

Revisions:	Description	Date	Approved



Sheet reference number		Prepared for:						
Sheet 4 of 9	GUADALUPE CREEK SANTA CLARA COUNTY, CA GROUND SURVEY CROSS SECTION LOCATIONS NOVEMBER 18- 24 SURVEY	JONES AND STOKES ASSOCIATES 2600 V STREET SACRAMENTO, CA 95818 916 737-3000 nhc northwest hydraulic consultants inc. 3950 industrial boulevard, suite 100c west sacramento, california 95691 (916) 371-7400	DRAFT	Designed by:	Date: February 7, 2000	File name:	Project No.:	Drawing Index No.:
				Dwn by: Ckd by:	Revised by:	PCP:		
				Revisions:	Description		Date	Approved



Sheet 5 of 9

Sheet reference number

GUADALUPE CREEK
SANTA CLARA COUNTY, CA

GROUND SURVEY CROSS SECTION LOCATIONS

NOVEMBER 18- 24 SURVEY

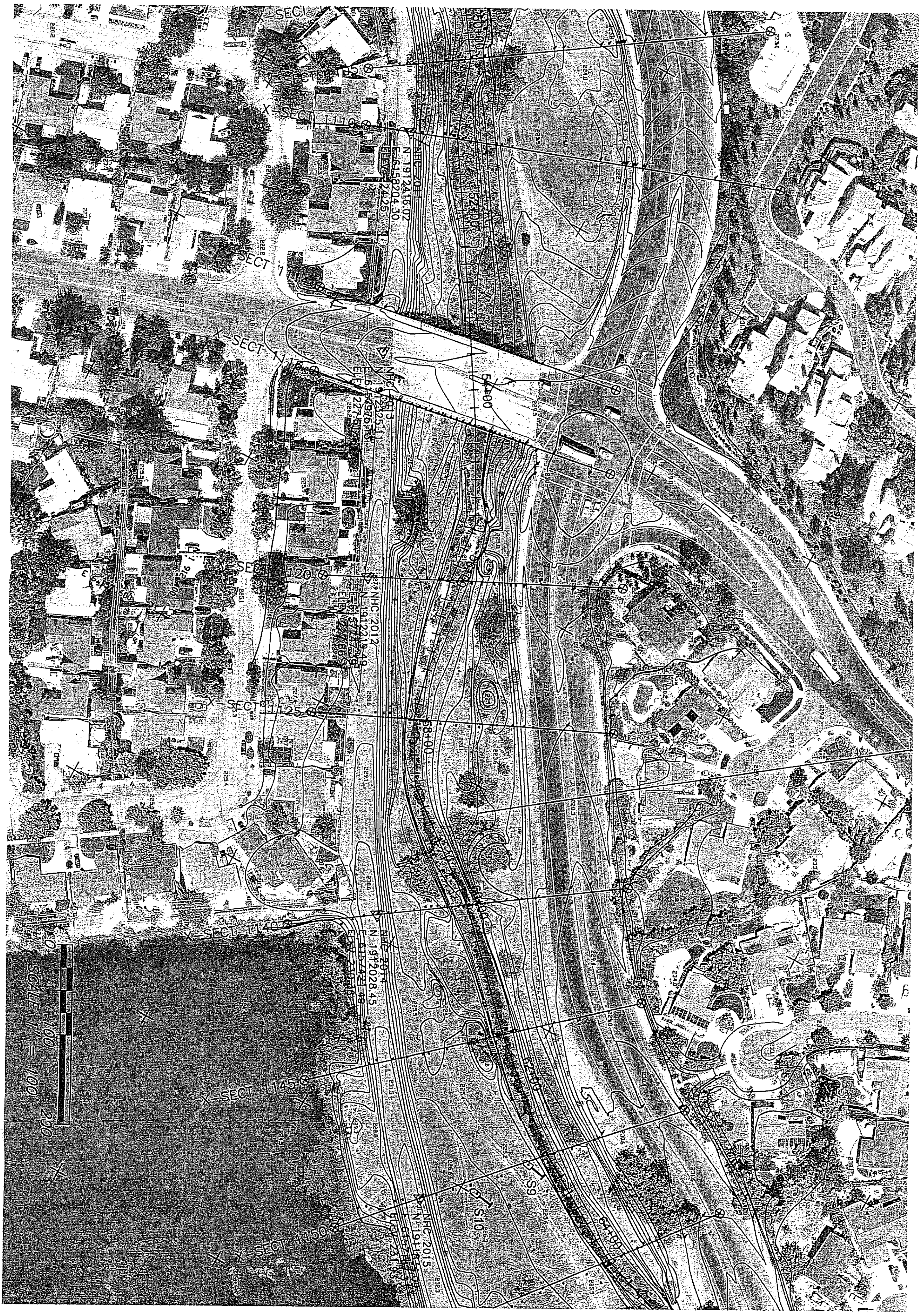
Prepared for:
JONES AND STOKES ASSOCIATES
2600 V STREET
SACRAMENTO, CA 95818
916 737-3000

nhc
northwest hydraulic consultants inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691
(916) 371-7400

DRAFT

Designed by:	Date: February 7, 2000	File name:		Project No.:	Drawing Index No.:
Dwn by:	Ckd by:	Revised by:	PCP:		

Revisions:	Description	Date	Approved



Sheet reference number

Sheet 6 of 9

GUADALUPE CREEK
SANTA CLARA COUNTY, CA

GROUND SURVEY CROSS SECTION LOCATIONS

NOVEMBER 18- 24 SURVEY

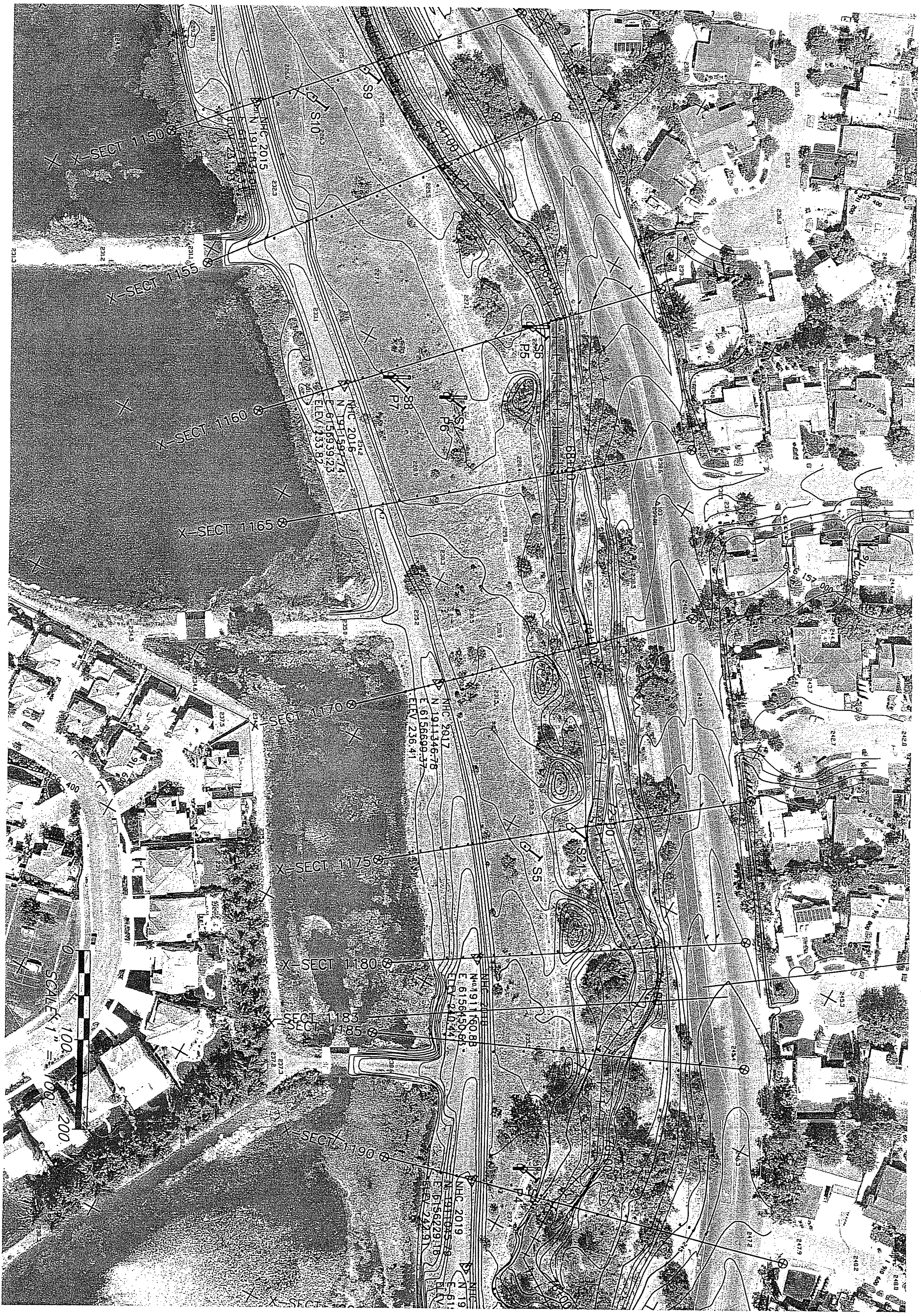
Prepared for:
JONES AND STOKES ASSOCIATES
2600 V STREET
SACRAMENTO, CA 95818
916 737-3000

nhc
northwest hydraulic consultants inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691
(916) 371-7400

DRAFT

Designed by:	Date: February 7, 2000	File name:	Project No.:	Drawing Index No.:
Dwn by: Ckd by:	Revised by:	PCP:		

Revisions:	Description	Date	Approved



Sheet reference number

Sheet 7 of 9

GUADALUPE CREEK
SANTA CLARA COUNTY, CA

GROUND SURVEY CROSS SECTION LOCATIONS

NOVEMBER 18- 24 SURVEY

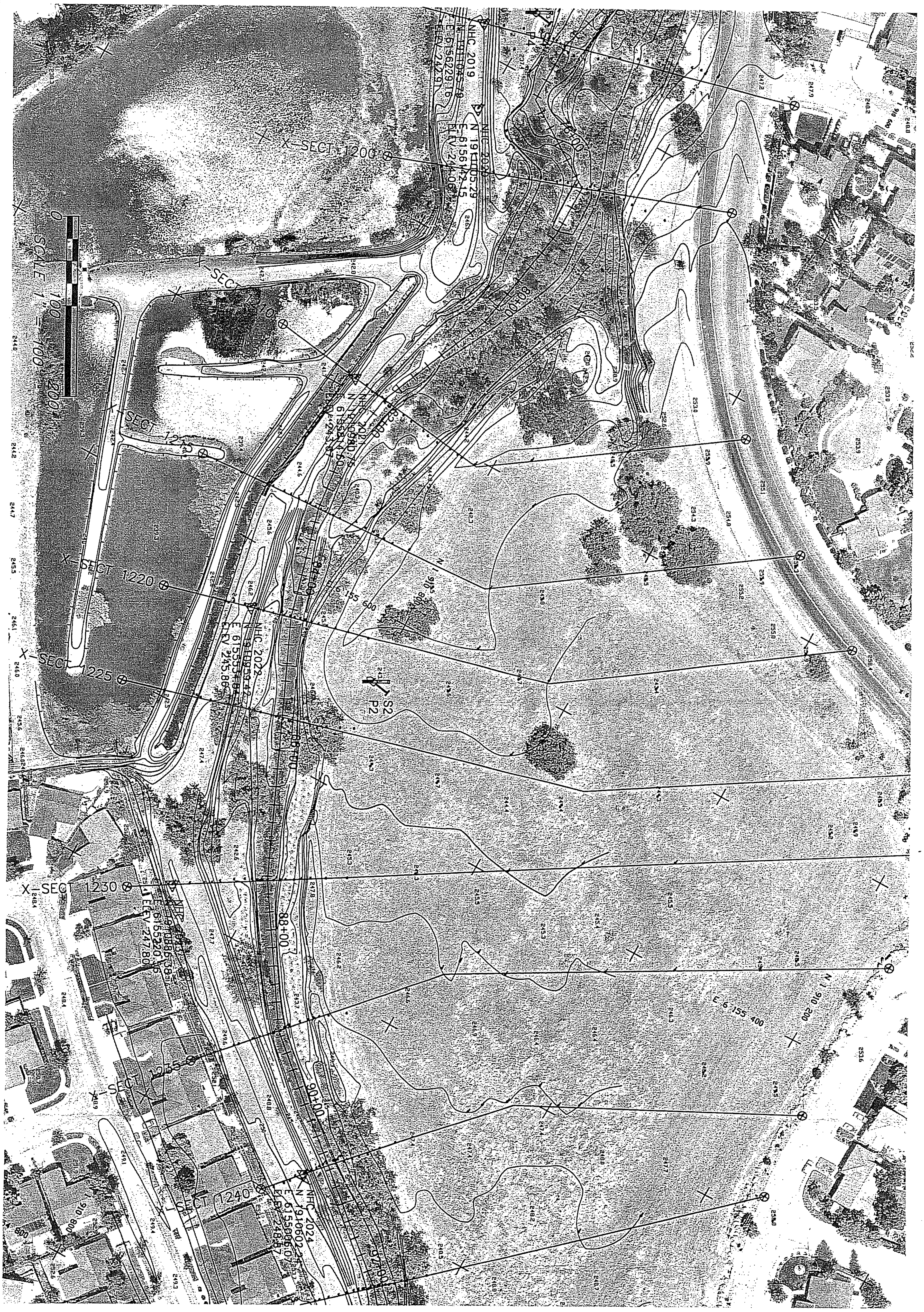
Prepared for:
JONES AND STOKES ASSOCIATES
2600 V STREET
SACRAMENTO, CA 95818
916 737-3000

nhc
northwest hydraulic consultants inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691
(916) 371-7400

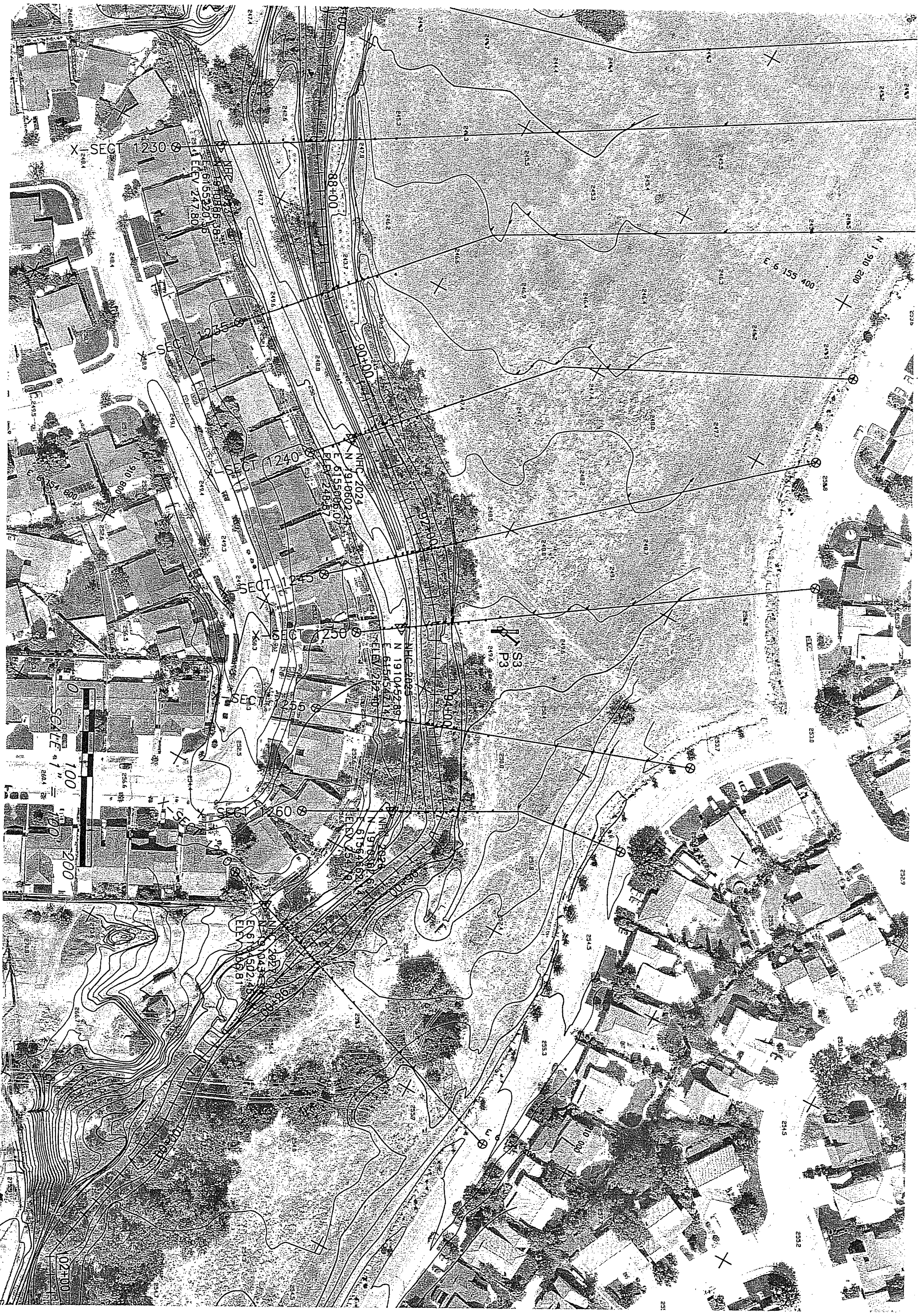
DRAFT

Designed by:	Date: February 7, 2000	File name:	Project No.:	Drawing Index No.:
Dwn by: Ckd by:	Revised by:	PCP:		

Revisions:	Description	Date	Approved



Sheet reference number Sheet 8 of 9	GUADALUPE CREEK SANTA CLARA COUNTY, CA GROUND SURVEY CROSS SECTION LOCATIONS NOVEMBER 18- 24 SURVEY	Prepared for: JONES AND STOKES ASSOCIATES 2600 V STREET SACRAMENTO, CA 95818 916 737-3000 nhc northwest hydraulic consultants inc. 3950 industrial boulevard, suite 100c west sacramento, california 95691 (916) 371-7400	DRAFT	Designed by: / Date: February 7, 2000 / File name: / Project No.: / Drawing Index No.: Dwn by: / Ckd by: / Revised by: / PCP: Revisions: / Description / Date / Approved



GUADALUPE CREEK
SANTA CLARA COUNTY, CA

GROUND SURVEY CROSS SECTION LOCATIONS

NOVEMBER 18- 24 SURVEY

Prepared for:
JONES AND STOKES ASSOCIATES
2600 V STREET
SACRAMENTO, CA 95818
916 737-3000

nhc northwest hydraulic consultants inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691
(916) 371-7400

DRAFT

Designed by:	Date: February 7, 2000	File name:	Project No.:	Drawing Index No.:
Dwn by: Ckd by:	Revised by:	PCP:		

Revisions:	Description	Date	Approved

Sheet reference number

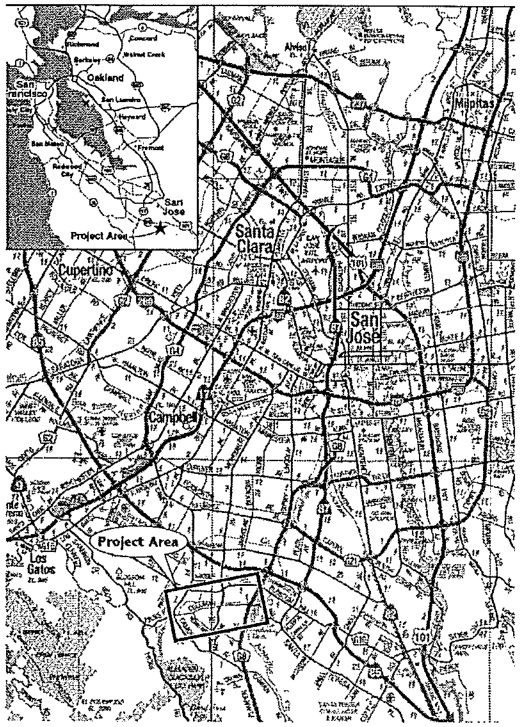
Sheet 9 of 9

Appendix C. Draft Submittal – Guadalupe Creek Restoration Plans

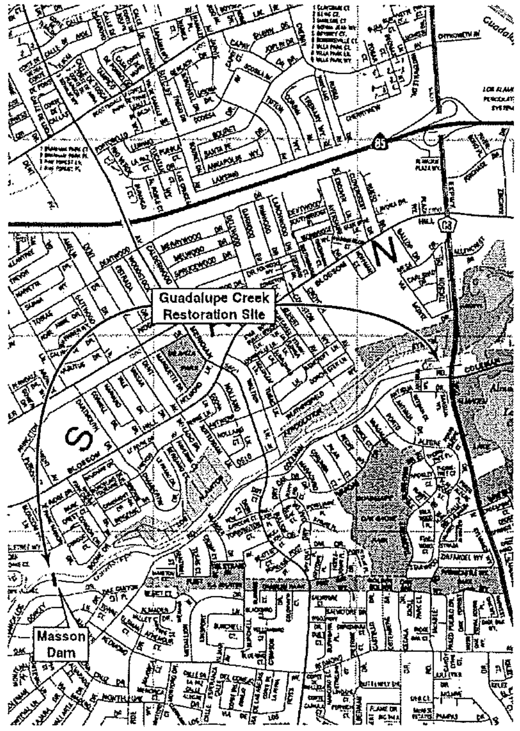
SHEET INDEX

SHEET #	SHEET NAME
	COVER SHEET
GEN-1	SITE ACCESS, HAUL ROUTES, STAGING AREAS, & GENERAL NOTES
GEN-2	LEGEND & SURVEY CONTROL DATA
G-1	GRADING PLAN
G-2	GRADING PLAN
G-3	GRADING PLAN
G-4	GRADING PLAN
G-5	GRADING PLAN
G-6	GRADING PLAN
G-7	GRADING PLAN
G-8	GRADING PLAN
G-9	GRADING PLAN
G-10	GRADING PLAN
G-11	GRADING PLAN
G-12	GRADING PLAN
G-13	GRADING PLAN
G-14	GRADING PLAN
G-15	GRADING PLAN
G-16	GRADING PLAN
G-17	GRADING PLAN
I-1	IRRIGATION PLAN
P-1	PLANTING PLAN
P-2	PLANTING PLAN
P-3	PLANTING PLAN
P-4	PLANTING PLAN

SHEET #	SHEET NAME
P-5	PLANTING PLAN
P-6	PLANTING PLAN
P-7	PLANTING PLAN
P-8	PLANTING PLAN
P-9	PLANTING PLAN
P-10	PLANTING PLAN
P-11	PLANTING PLAN
P-12	PLANTING PLAN
P-13	PLANTING PLAN
P-14	PLANTING PLAN
P-15	PLANTING MATRIX
D-1	INSTREAM STRUCTURES DETAILS
D-2	INSTREAM STRUCTURES DETAILS
D-3	INSTREAM STRUCTURES DETAILS
D-4	INSTREAM STRUCUTRES DETAILS
D-5	INSTREAM STRUCTURES DETAILS
D-6	CHANNEL REALIGNMENT DETAILS
D-7	CHANNEL REALIGNMENT DETAILS
D-8	PLANTING DETAILS
D-9	PLANTING DETAILS
XS-1	CROSS-SECTIONS



VICINITY MAP N



LOCATION MAP N

PROJECT LOCATION

MAP AND CONSTRUCTION PLAN

FOR

GUADALUPE CREEK RESTORATION PROJECT

PROJECT NO. 301517 0629

JULY 17, 2000

PROJECT APPROVAL:

____
ASSISTANT OPERATING OFFICER
GUADALUPE WATERSHED
WATERSHED MANAGEMENT DIVISION

ACCEPTED BY DISTRICT:

____
SENIOR PROJECT MANAGER
PROJECT MANAGEMENT UNIT

DATE: ____________________

Santa Clara Valley Water District

PROJECT PREPARED BY:

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

DRAFT SUBMITTAL
NOT FOR CONSTRUCTION

ENGINEERING APPROVAL:

____
JOHN ZANZI
JONES & STOKES

CALIFORNIA LICENSED
LANDSCAPE ARCHITECT NO. 2933

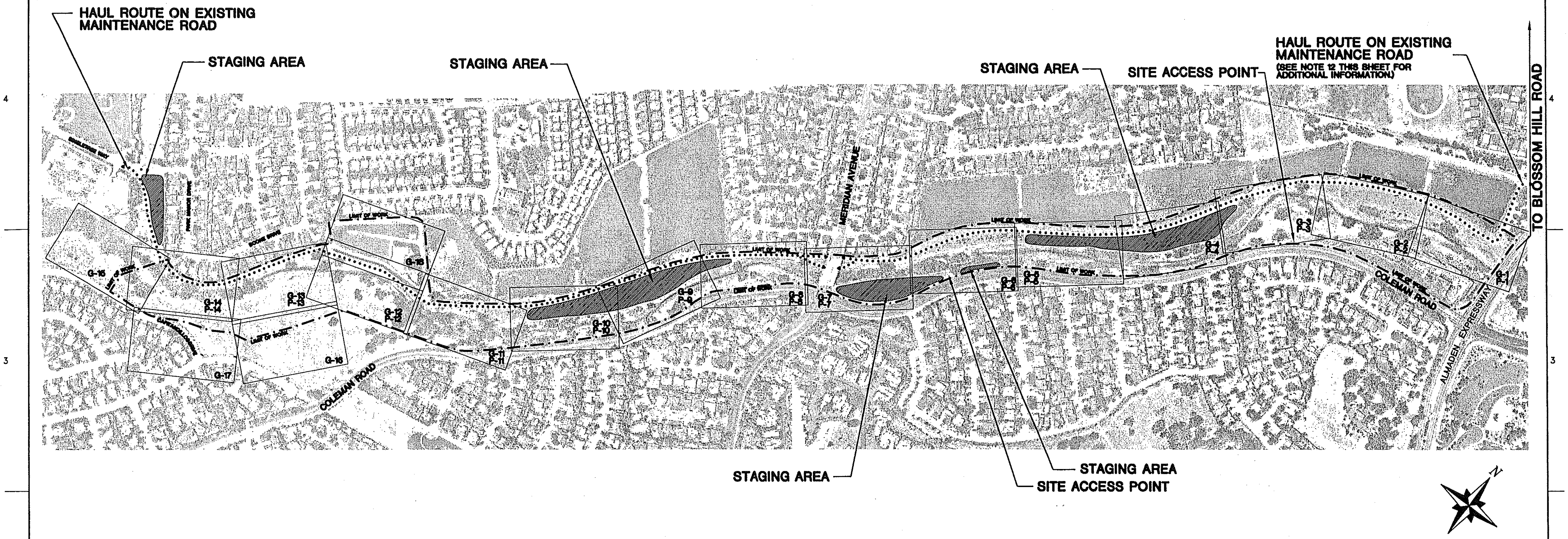
DATE: ____________________

XXXXX
EXP. XX/XX/XX
CIVIL

____
ED WALLACE RCE NO. 32301
NORTHWEST HYDRAULIC CONSULTANTS

DATE: ____________________

FILE NAME:
DATE:



GENERAL NOTES:

1. THESE CONSTRUCTION DOCUMENTS HAVE BEEN PREPARED USING THE BEST AVAILABLE INFORMATION WITHIN ACCEPTED INDUSTRY STANDARDS.

2. THE CONTRACTOR WILL CONTACT THE ENGINEER IMMEDIATELY UPON FINDING ANY FIELD CONDITIONS THAT WOULD CONFLICT WITH THE INFORMATION INDICATED ON THESE DRAWINGS. ALL FIELD ADJUSTMENTS MUST BE APPROVED BY THE ENGINEER BEFORE CONSTRUCTION OF SAID ADJUSTMENTS; FAILURE TO DO SO WILL RESULT IN THE CONTRACTOR ASSUMING FULL RESPONSIBILITY FOR ANY REQUIRED REVISIONS OR FIELD MODIFICATIONS, AS DIRECTED BY THE ENGINEER, AT NO ADDITIONAL COST.

3. THE CONTRACTOR WILL BE RESPONSIBLE FOR COORDINATING THE SCHEDULING OF CONSTRUCTION OPERATIONS WITH CONSTRUCTION OPERATIONS OF OTHERS WORKING ON OR NEAR THE PROJECT SITE.

4. THE CONTRACTOR WILL VERIFY THE LOCATION OF ALL EXISTING UNDERGROUND UTILITIES BEFORE ANY CONSTRUCTION OPERATIONS. TO FIELD-LOCATE ALL EXISTING UTILITIES, THE CONTRACTOR WILL CALL ALL GOVERNING AGENCIES AND UNDERGROUND SERVICE ALERT (U.S.A.) AT 1-(800)-642-2444.

5. THE CONSTRUCTION STAGING AREAS WILL BE AT THE LOCATIONS SHOWN ON THE DRAWINGS, AND IN OTHER AREAS APPROVED BY THE ENGINEER. ACCESS AND HAUL ROUTES WILL BE LIMITED TO THOSE SHOWN IN THE DRAWINGS, UNLESS OTHERWISE APPROVED BY THE ENGINEER.

6. THE CONTRACTOR WILL BE RESPONSIBLE FOR TAKING APPROPRIATE PRECAUTIONS TO MINIMIZE THE CHANCE OF FIRE AT THE PROJECT SITE. THE CONTRACTOR WILL USE EXISTING DIRT ROADS, OR OTHER AREAS WITH WEEDS AND OTHER PLANT GROWTH WITH A HEIGHT OF LESS THAN 6 INCHES FOR CONSTRUCTION ACCESS. EACH VEHICLE WILL BE EQUIPPED WITH A MINIMUM OF ONE FIRE EXTINGUISHER AND ONE SHOVEL. GASOLINE WILL BE STORED IN SEALED METAL CANS LABELED "FLAMMABLE". NO BURNING WILL BE PERMITTED AT THE PROJECT SITE. VEHICLE AND EQUIPMENT PARKING WILL BE LIMITED TO THE CONSTRUCTION STAGING AREAS PER THE LOCATION INDICATED ON THE DRAWINGS. THE CONTRACTOR WILL SCRAPE AND CLEAN THE LIMITS OF THE CONSTRUCTION STAGING AREAS TO BE VEGETATION FREE ACCORDING TO THE ENGINEER'S DIRECTION. THROUGHOUT THE CONTRACT PERIOD, THE CONTRACTOR WILL BE RESPONSIBLE FOR MAINTAINING THE CONSTRUCTION STAGING AREAS FREE OF WEEDS AND OTHER PLANT GROWTH OF A HEIGHT GREATER THAN 6 INCHES. FOR THIS CONTRACT, THE FIRE DANGER SEASON IS DEFINED AS EXTENDING FROM MAY 1 TO OCTOBER 31 OF EACH YEAR COVERED BY THIS CONTRACT, AND AT ANY OTHER TIMES IF CONDITIONS WARRANT AS DETERMINED BY THE ENGINEER.

7. ALL LUBRICATION, REFUELING, OR MAINTENANCE OF EARTHMOVING OR OTHER CONSTRUCTION VEHICLES WILL BE DONE WITHIN APPROVED CONSTRUCTION STAGING AREAS.

8. THE CONTRACTOR WILL BE RESPONSIBLE FOR KEEPING THE PROJECT SITE IN A NEAT AND ORDERLY CONDITION, FREE OF RUBBISH AND DEBRIS, AT ALL TIMES.

9. THE CONTRACTOR WILL SPRAY ALL UNPAVED CONSTRUCTION AREAS WITH WATER AT LEAST THREE TIMES EACH DAY WITHIN AREAS BEING GRADED, EXCAVATED OR USED AS CONSTRUCTION HAUL ROADS; SPRAYING WILL OCCUR MORE FREQUENTLY ON HOT AND WINDY DAYS.

10. ELEVATIONS SHOWN ON THE DRAWINGS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM OF 1929 (NGVD29). BASELINE AND CONTROL DATA ARE SHOWN ON SHEET GEN-2. ALL BENCH MARKS AND MONUMENTS SHOWN ON THE DRAWINGS MUST BE PROTECTED AND PRESERVED THROUGHOUT THE CONTRACT PERIOD.

11. EXISTING CONDITIONS SHOWN ON THE DRAWINGS ARE BASED ON AERIAL PHOTOGRAPHY DATED SEPTEMBER 22, 1999, AND FIELD SURVEYS DATED MAY 29TH, 2000. ACTUAL CONDITIONS AT THE TIME OF CONSTRUCTION MAY VARY FROM THOSE SHOWN.

12. THE DOWNSTREAM END OF THE PROJECT SITE IS ACCESSIBLE BY WAY OF A MAINTENANCE ROAD AND GATE LOCATED OFF ALMADEN EXPRESSWAY, BETWEEN COLEMAN ROAD (SOUTH) AND BLOSSOM HILL ROAD (NORTH), APPROXIMATELY 500 FEET NORTH OF THE CREEK.

13. SITE ACCESS POINTS WILL BE USED FOR EQUIPMENT ACCESS TO SPECIFIC AREAS OF WORK. GENERAL DELIVERY OF MATERIALS TO THE SITE WILL NOT BE PERMITTED THROUGH THESE POINTS.

14. ACCESS THROUGH GATES ON THE MAINTENANCE ROAD AT MERIDIAN AVENUE WILL BE LIMITED TO PICK-UP TRUCKS AND PASSENGER VEHICLES.

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	07/14/00
DESIGN	BPH
DRAWN	BPH
CHECKED	JAZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK RESTORATION PROJECT
SITE ACCESS, HAUL ROUTES, STAGING AREAS, & GENERAL NOTES

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
1"=280'

SHEET
GEN-1

2 OF 47

CONTROL DATA

POINT #	NORTH	EAST	ELEV.	DESC.
100	1914828.55	6161008.08	198.34	BRASS PIN MON
101	1913755.25	6161444.93	202.20	FD. PK NAIL
102	1912047.83	6159050.17	217.07	SET PK NAIL
103	1911230.07	6156990.53	239.08	SET MAG NAIL
104	1909617.25	6154716.49	253.44	SET MAG NAIL
105	1911161.71	6154001.72	273.31	SET LARGE NAIL
106	1912503.32	6156235.17	240.01	SET MAG NAIL
107	1913681.29	6158117.12	215.64	SET MAG NAIL

HORIZONTAL DATUM : NAD83
VERTICAL DATUM: NGVD29, US FEET

BASE LINE DATA

STATION	BEARING	LENGTH	DELTA	RADIUS
0+00				
	N82°32'13"W	175.51'		
B.C.1+75.51				
		1361.60'	51°44'58"	1507.53'
E.C.15+37.11				
	S40°58'50"W	455.77'		
B.C.19+92.88				
		597.84'	23°58'30"	1428.74'
E.C.25+90.72				
	S65°46'28"W	420.34'		
B.C.30+11.06				
		496.92'	27°17'40"	1043.11'
E.C.35+07.98				
	S35°58'24"W	162.86'		
B.C.36+70.84				
		164.69'	28°55'48"	326.17'
E.C.38+35.53				
	S64°54'12"W	788.34'		
B.C.46+23.87				
		445.96'	18°36'53"	1372.68'
E.C.50+69.83				
	S43°33'52"W	532.84'		
B.C.56+02.67				
		571.21'	17°59'13"	1819.54'
E.C.61+73.88				
	S63°48'10"W	315.44'		
B.C.64+89.32				
		204.13'	39°3'35"	299.43'
E.C.66+93.45				
	S77°8'15"W	120.34'		
B.C.68+13.79				
		185.18'	24°38'30"	430.58'
E.C.69+98.97				
	S80°51'55"W	271.51'		
B.C.72+70.48				
		66.41'	38°4'2"	99.95'
E.C.73+36.89				
	S40°35'5"W	344.69'		
B.C.76+81.58				
		337.99'	26°28'39"	731.4'
E.C.80+19.57 B.C.80+19.57				
		351.19'	69°8'54"	291.34'
E.C.83+70.76				

LEGEND

SYMBOL	DESCRIPTION
	SURVEY MONUMENT
253.7	AERIAL SURVEY SPOT ELEVATION
	FIELD SURVEYED SPOT ELEVATION
— —	INTERMEDIATE CONTOUR
— —	INDEX CONTOUR
——	PROPOSED CONTOUR
231.5	PROPOSED SPOT ELEVATION
231.5(C) 234.0(C)	GRADING CATCH POINT
68+00	BASE LINE
— X —	VEGETATION PRESERVATION FENCE
	REMOVE VEGETATION
T1	TRANSPLANT EXISTING VEGETATION
	EXISTING CHAIN-LINK FENCE
——E——	EXISTING ELECTRIC UTILITY LINE
——W——	EXISTING CITY WATER MAIN
— · · · —	LOW-FLOW EDGE OF WATER
	PROPOSED CHAIN-LINK FENCE
POST	POST
18+85	CROSS SECTION
1/D-8	DETAIL OR SECTION CALLOUT
▨	BANK PROTECTION SITE

LEGEND

SYMBOL	DESCRIPTION	DETAIL
V	BAR INSTREAM WOODY MATERIAL (IWM)	1/D-2
	LOG STREAM BARB	4/D-1
	WATER'S EDGE TREATMENT	2/D-1
	OFF-BANK BRANCH COVER	3/D-2
	OFF-BANK LOG COVER	2/D-2
	OVERBANK WOODY MATERIAL (OWM)	3/D-3
	ROOTWAD BANK STRUCTURE-TYPE 1	1/D-3
	ROOTWAD BANK STRUCTURE-TYPE 2	2/D-3
	STREAMBANK IWM	3/D-1
	LOG TOE BANK STRUCTURE	1/D-4
V	WING DEFLECTOR	4/D-3
	ROCK STREAM BARB	2/D-4
	V-WEIR	1/D-6
	CROSS-WEIR	2/D-6
	BURIED GROIN	3/D-6
	STREAM BOULDER PLACEMENT	1/D-1

ABBREVIATIONS

ABBREV.	DESCRIPTION
IWM	INSTREAM WOODY MATERIAL
OWM	OVERBANK WOODY MATERIAL
CMP	CORRIGUATED METAL PIPE
RCP	REINFORCED CONCRETE PIPE
B.C.	BEGINNING OF CURVE
E.C.	END OF CURVE
F.D.	FOUND
MAG NAIL	MAGNESIUM NAIL
MON	MONUMENT
LF	LINEAR FEET
MIN	MINIMUM
ELEV.	ELEVATION
NAD	NORTH AMERICAN DATUM
NGVD	NATIONAL GEODETIC VERTICAL DATUM
DESC.	DESCRIPTION

TRANSPLANT AND REMOVAL LIST

SHEET	AREA	PLANT NAME	NUMBER	HEIGHT	DIAMETER	COMMENTS
G-2	T1					
	T2					
G-3	T2	WILLOW	1			
G-4	T1					
	T2					
G-5	T1	SYCAMORE	4	1'-2'		
		WILLOW	20	3'-8'		
	T2	WILLOW	5	3'-8'		
	T3	SYCAMORE	1	2'		
		WILLOW	1	12'		
	R1	MYRTLE				
	R2	MYRTLE				
G-6	T1					
	T2	WILLOW				
	T3	SYCAMORE	1	2'		
	R1	SPECIES				
G-7	T1	WILLOW		3'		
	R1	SYCAMORE				SALVAGE 1-3 TRUNKS@12" DIA.
	R2	SCOTCH BROOM				
G-8	T1					
	T2	MULEFAT	4	10'-15'	AS SHOWN	
	T3	MULEFAT	1	10'-15'	AS SHOWN	
	T4	MULEFAT	3	10'-15'		
	T5	MULEFAT	1	10'-15'		
G-9	T1	MULEFAT	1	10'-15'		
	T2					
	T3	MULEFAT	1	8'	AS SHOWN	
G-10	T1	MULEFAT	1	10'-15'		
	T2	MULEFAT	1	10'-15'		
	T3	MULEFAT	3	10'		
	T4	BUCKEYE	1	5'		
	R1	WALNUT	MULTI-TRUNK	20'	3@7", 10@3"	
	R2	WALNUT	MULTI-TRUNK	20'	ALL@3"	
	R3	SYCAMORE	1			STOCKPILE ROOTWAD & TRUNKS
	R4	SYCAMORE	2 TRUNKS			STOCKPILE ROOTWAD & TRUNKS (2)
G-13	T1	MULEFAT	6			
	T2	PHASE 1 PLANTING	23			
	T3	PHASE 1 PLANTING	57			
	T4	MULEFAT				
	T5	MULEFAT				
	R1	POISON OAK				
	R2	OAK				USE AS IWM
	R3	WILD ROSE				
	R4	POISON OAK				
	R5	OAK				USE AS IWM
G-14	T1	ELDERBERRY	2		1@10'-15', 1@5'-10'	
	T2	ELDERBERRY	1		10'-15'	
	T3	MULEFAT				
	T4	ELDERBERRY	1		10'-15'	

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

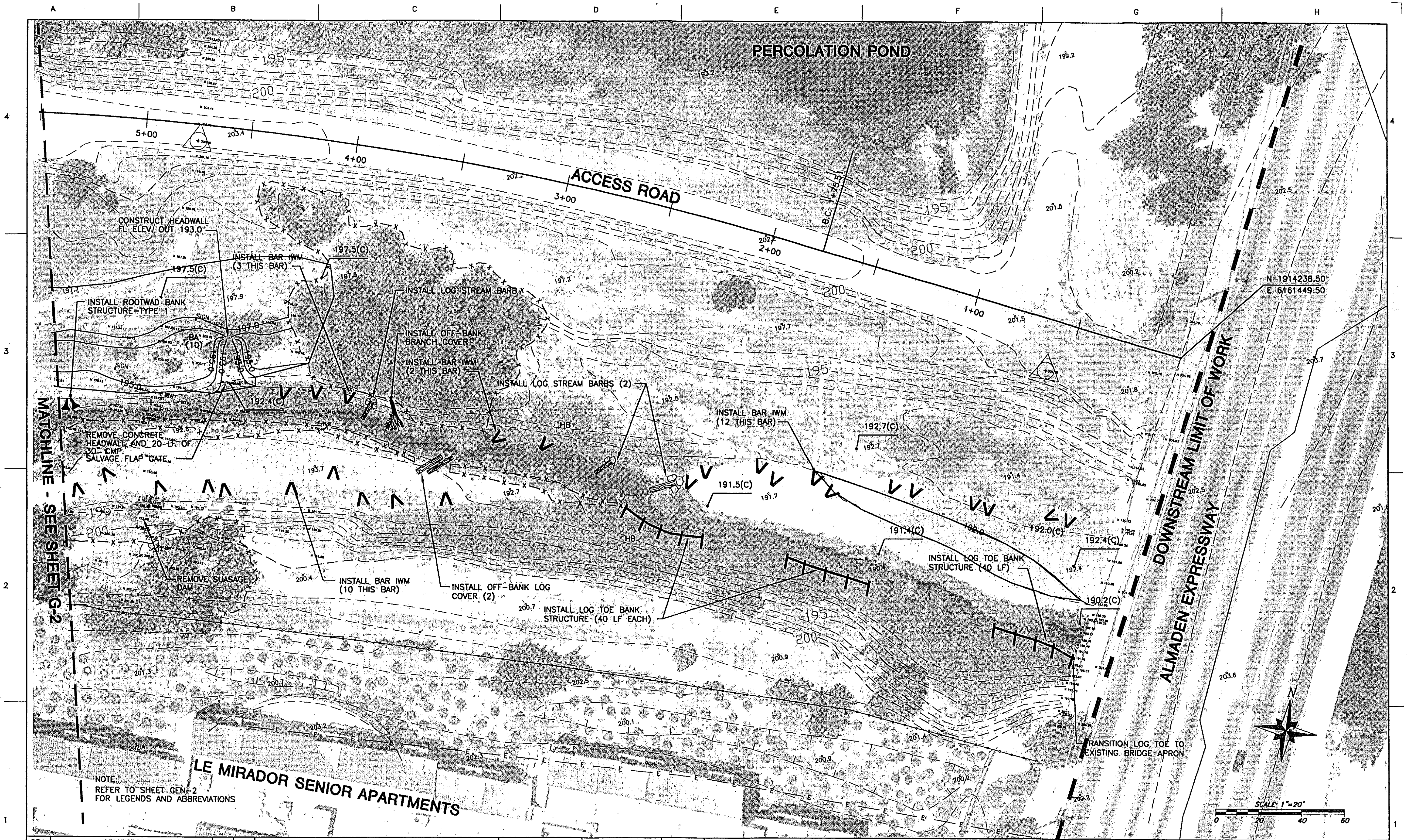
DATE 07/14/00
DESIGN BPH
DRAWN BPH
CHECKED JAZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT
LEGEND & SURVEY CONTROL DATA

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE 1"=280'
SHEET
GEN-2
3 OF 47


PERCOLATION POND
ACCESS ROAD
5+00
4+00
3+00
2+00
1+00
B.C. 1+75
195
200
CONSTRUCT HEADWALL FL ELEV OUT 193.0
INSTALL BAR IWM (3 THIS BAR)
197.5(C)
INSTALL LOG STREAM BARB
INSTALL ROOTWAD BANK STRUCTURE-TYPE 1
BAR (10)
SIGN
197.0
192.4(C)
INSTALL OFF-BANK BRANCH COVER
INSTALL BAR IWM (2 THIS BAR)
INSTALL LOG STREAM BARBS (2)
REMOVE CONCRETE HEADWALL AND 20 LF OF 30" CMP. SALVAGE FLAP GATE
HB
INSTALL BAR IWM (12 THIS BAR)
192.7(C)
191.5(C)
192.0(C)
192.4(C)
191.4(C)
190.2(C)
INSTALL LOG TOE BANK STRUCTURE (40 LF)
N 1914238.50
E 6161449.50
DOWNSTREAM LIMIT OF WORK
ALMADEN EXPRESSWAY
MATCHLINE - SEE SHEET G-2
REMOVE SUASAGE DAM
INSTALL BAR IWM (10 THIS BAR)
INSTALL OFF-BANK LOG COVER (2)
INSTALL LOG TOE BANK STRUCTURE (40 LF EACH)
TRANSITION LOG TOE TO EXISTING BRIDGE APRON
LE MIRADOR SENIOR APARTMENTS
NOTE: REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS
SCALE 1"=20'
0
20
40
60
N

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

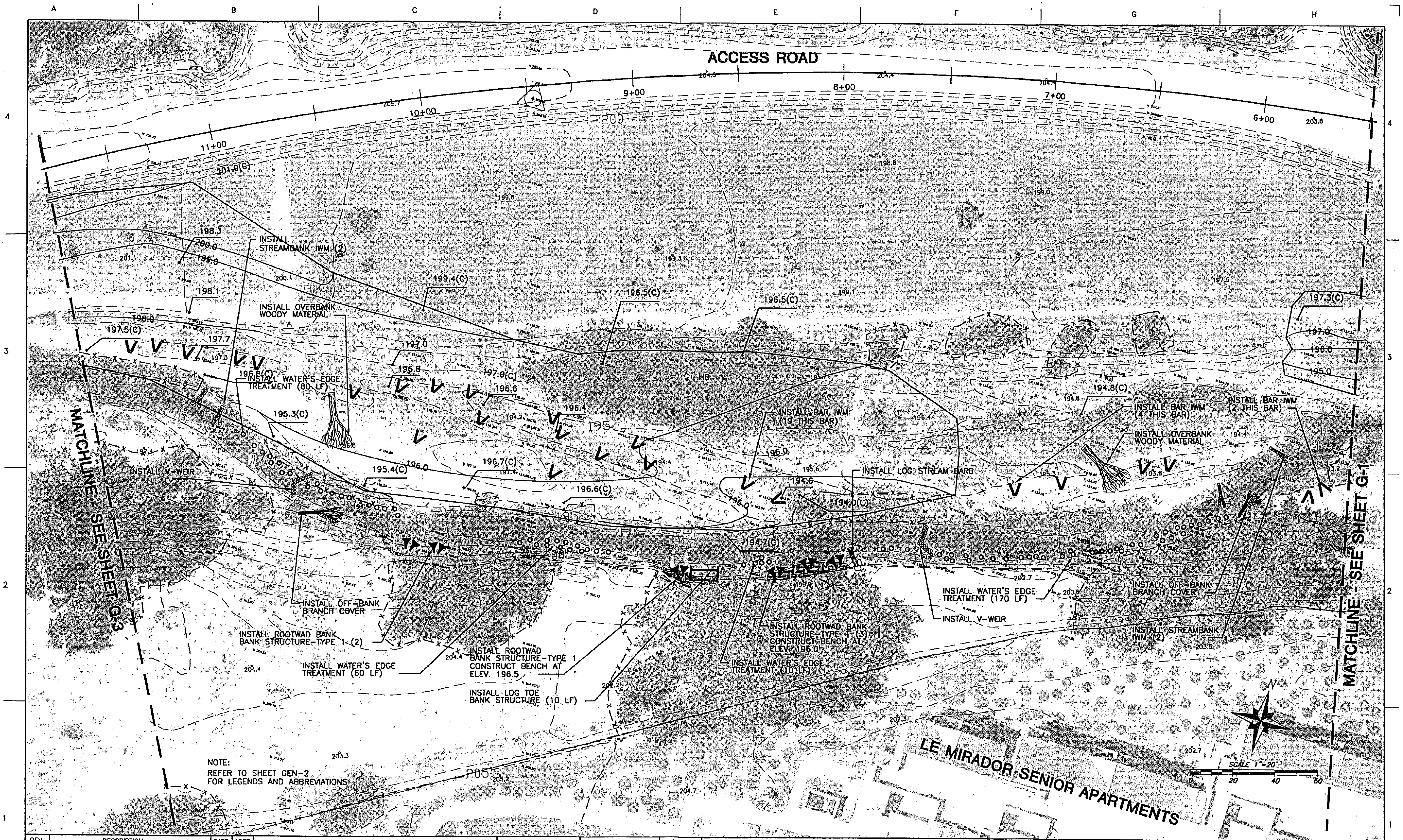
GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
G-1
4 OF 47



ACCESS ROAD
11+00
10+00
9+00
8+00
7+00
6+00
205.7
204.6
204.4
204.4
203.8
200
201.0(C)
198.8
199.6
199.0
199.3
199.1
197.5
198.3
200.0
199.0
201.1
200.1
198.1
198.0
197.5(C)
197.7
197.3
196.8(C)
INSTALL STREAMBANK IWM (2)
199.4(C)
INSTALL OVERBANK WOODY MATERIAL
197.0
196.8
197.0(C)
196.6
196.4
INSTALL WATER'S EDGE TREATMENT (80 LF)
195.3(C)
195
196.5(C)
196.5(C)
HB
195.7
196.0
195.4(C)
196.0
196.7(C)
196.6(C)
194.2
194.4
195.6
194.6
195.0
194.0(C)
194.7(C)
INSTALL BAR IWM (19 THIS BAR)
INSTALL LOG STREAM BARB
195.4
194.8
194.8(C)
INSTALL BAR IWM (4 THIS BAR)
INSTALL OVERBANK WOODY MATERIAL
INSTALL BAR IWM (2 THIS BAR)
194.4
193.8
195.3
197.3(C)
197.0
196.0
195.0
INSTALL V-WEIR
MATCHLINE - SEE SHEET G-3
MATCHLINE - SEE SHEET G-1
INSTALL OFF-BANK BRANCH COVER
INSTALL ROOTWAD BANK BANK STRUCTURE-TYPE 1 (2)
INSTALL WATER'S EDGE TREATMENT (60 LF)
INSTALL ROOTWAD BANK STRUCTURE-TYPE 1 CONSTRUCT BENCH AT ELEV. 196.5
INSTALL LOG TOE BANK STRUCTURE (10 LF)
INSTALL ROOTWAD BANK STRUCTURE-TYPE 1 (3) CONSTRUCT BENCH AT ELEV. 196.0
INSTALL WATER'S EDGE TREATMENT (10 LF)
INSTALL WATER'S EDGE TREATMENT (170 LF)
INSTALL V-WEIR
INSTALL OFF-BANK BRANCH COVER
INSTALL STREAMBANK IWM (2)
199.9
202.7
200.6
203.5
204.4
204.4
202.2
202.3
202.7
203.3
205
205.2
204.7
LE MIRADOR SENIOR APARTMENTS
N
SCALE 1"=20'
0
20
40
60
A
B
C
D
E
F
G
H
1
2
3
4

NOTE:
REFER TO SHEET GEN-2
FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

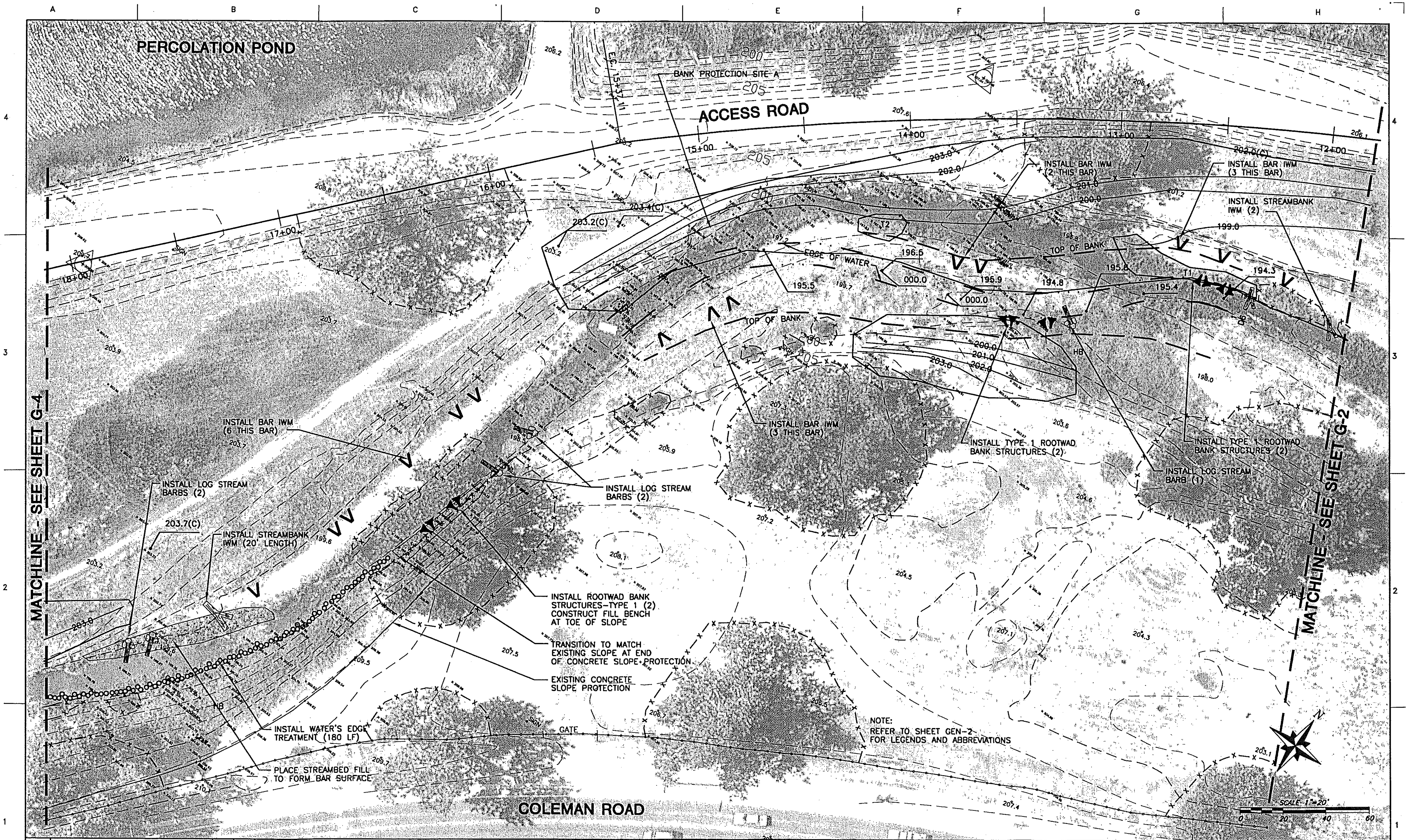
GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
G-2
5 OF 47


PERCOLATION POND
ACCESS ROAD
BANK PROTECTION SITE A
E.C. 15+37.11
18+00
17+00
16+00
15+00
14+00
13+00
12+00
203.4(C)
203.2(C)
202.0(C)
203.0
202.0
201.0
200.0
199.0
TOP OF BANK
EDGE OF WATER
196.6
195.5
195.9
194.8
195.8
195.4
194.3
000.0
T1
T2
HB
INSTALL BAR IWM (2 THIS BAR)
INSTALL BAR IWM (3 THIS BAR)
INSTALL STREAMBANK IWM (2)
INSTALL BAR IWM (3 THIS BAR)
INSTALL TYPE 1 ROOTWAD BANK STRUCTURES (2)
INSTALL TYPE 1 ROOTWAD BANK STRUCTURES (2)
INSTALL LOG STREAM BARB (1)
MATCHLINE - SEE SHEET G-2
MATCHLINE - SEE SHEET G-4
INSTALL BAR IWM (6 THIS BAR)
INSTALL LOG STREAM BARBS (2)
INSTALL LOG STREAM BARBS (2)
203.7(C)
INSTALL STREAMBANK IWM (20' LENGTH)
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2) CONSTRUCT FILL BENCH AT TOE OF SLOPE
TRANSITION TO MATCH EXISTING SLOPE AT END OF CONCRETE SLOPE PROTECTION
EXISTING CONCRETE SLOPE PROTECTION
INSTALL WATER'S EDGE TREATMENT (180 LF)
PLACE STREAMBED FILL TO FORM BAR SURFACE
SGN
GATE
COLEMAN ROAD
N
SCALE 1"=20'
0
20'
40
60

NOTE:
REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

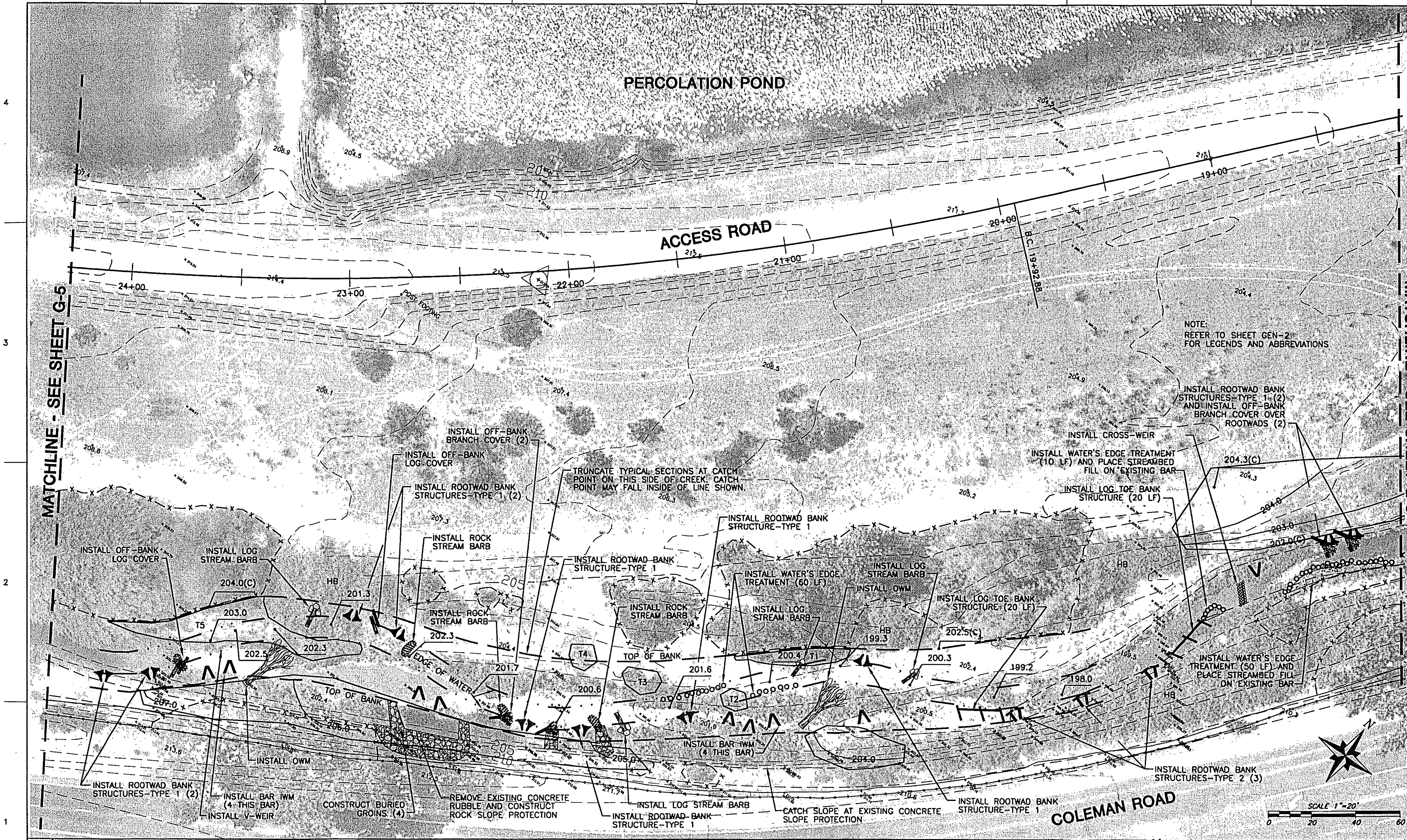
GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
G-3
6 OF 47


PERCOLATION POND
ACCESS ROAD
COLEMAN ROAD
MATCHLINE - SEE SHEET G-5
MATCHLINE - SEE SHEET G-3
24+00
23+00
22+00
21+00
20+00
19+00
B.C. 19+92.88
POST FOOTING
INSTALL OFF-BANK BRANCH COVER (2)
INSTALL OFF-BANK LOG COVER
TRUNCATE TYPICAL SECTIONS AT CATCH POINT ON THIS SIDE OF CREEK. CATCH POINT MAY FALL INSIDE OF LINE SHOWN.
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2)
INSTALL ROCK STREAM BARB
INSTALL OFF-BANK LOG COVER
INSTALL LOG STREAM BARB
INSTALL ROOTWAD BANK STRUCTURE-TYPE 1
INSTALL ROCK STREAM BARB
INSTALL ROCK STREAM BARB
INSTALL ROOTWAD BANK STRUCTURE-TYPE 1
INSTALL WATER'S EDGE TREATMENT (60 LF)
INSTALL LOG STREAM BARB
INSTALL OWM
INSTALL LOG STREAM BARB
INSTALL LOG TOE BANK STRUCTURE (20 LF)
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2) AND INSTALL OFF-BANK BRANCH COVER OVER ROOTWADS (2)
INSTALL CROSS-WEIR
INSTALL WATER'S EDGE TREATMENT (10 LF) AND PLACE STREAMBED FILL ON EXISTING BAR
INSTALL LOG TOE BANK STRUCTURE (20 LF)
INSTALL WATER'S EDGE TREATMENT (50 LF) AND PLACE STREAMBED FILL ON EXISTING BAR
INSTALL ROOTWAD BANK STRUCTURES-TYPE 2 (3)
INSTALL ROOTWAD BANK STRUCTURE-TYPE 1
CATCH SLOPE AT EXISTING CONCRETE SLOPE PROTECTION
INSTALL LOG STREAM BARB
INSTALL ROOTWAD BANK STRUCTURE-TYPE 1
REMOVE EXISTING CONCRETE RUBBLE AND CONSTRUCT ROCK SLOPE PROTECTION
CONSTRUCT BURIED GROINS (4)
INSTALL BAR IWM (4 THIS BAR)
INSTALL V-WEIR
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2)
INSTALL OWM
INSTALL BAR IWM (4 THIS BAR)
TOP OF BANK
EDGE OF WATER
TOP OF BANK
HB
HB
HB
HB
T1
T2
T3
T4
T5
204.0(C)
203.0
202.3
202.5
201.3
202.3
201.7
200.6
201.6
200.4
199.3
200.3
202.5(C)
199.2
198.0
204.3(C)
204.0
203.0
202.0(C)
207.0
206.0
205.0
204.0
205
210
208.9
204.5
208.1
208.8
207.4
207.3
206.3
206.5
205.2
204.9
204.4
204.3
201.9
200.5
202.4
199.5
213.6
212.5
211.7
210.6
N
SCALE 1"=20'
0
20
40
60

NOTE:
REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

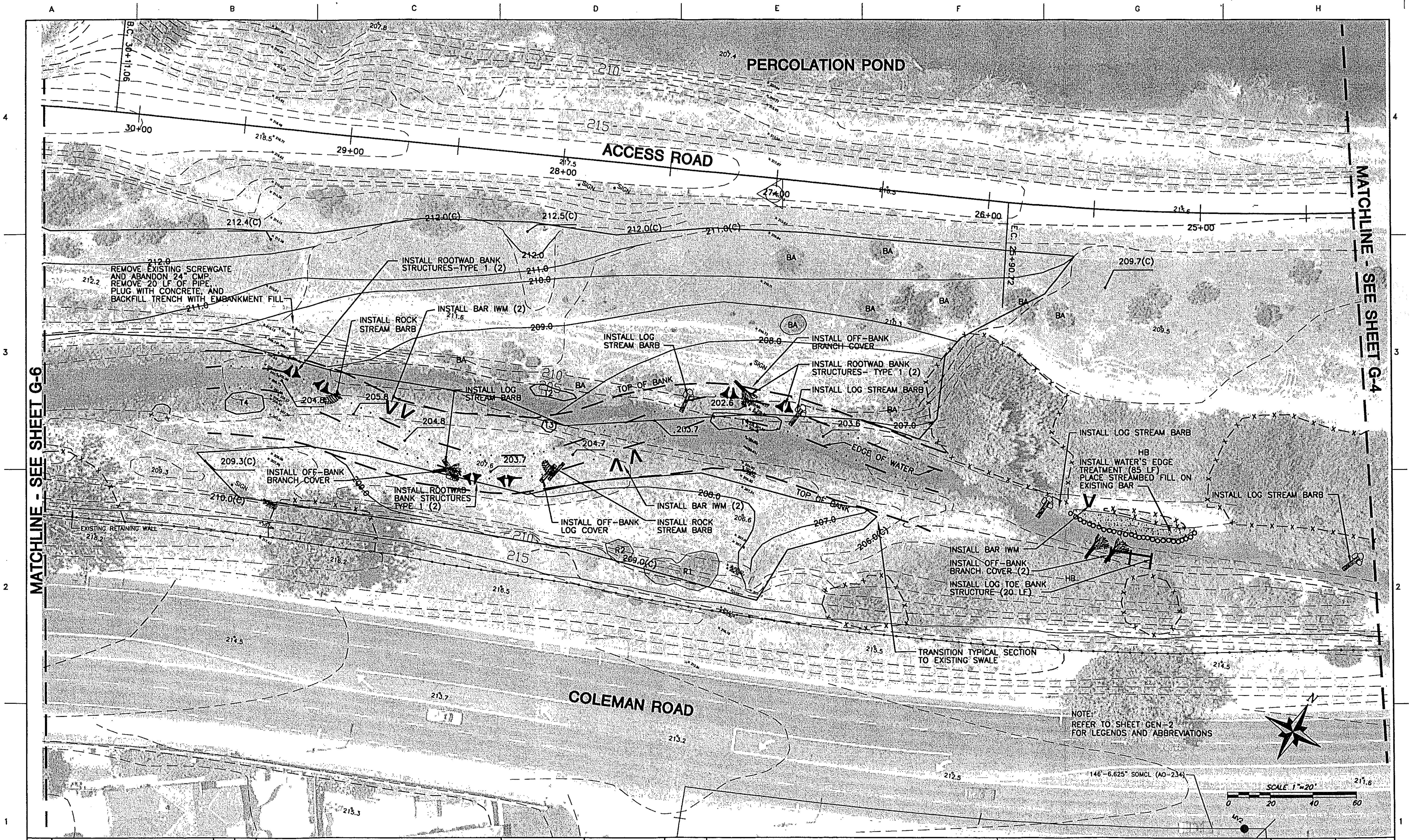
GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
G-4
7 OF 47


PERCOLATION POND
ACCESS ROAD
COLEMAN ROAD
MATCHLINE - SEE SHEET G-6
MATCHLINE - SEE SHEET G-4
B.C. 30+11.06
E.C. 25+90.72
30+00
29+00
28+00
27+00
26+00
25+00
210
215
207.8
207.4
218.5
217.5
212.4(C)
212.0(C)
212.5(C)
212.0(C)
211.0(C)
212.0
211.0
210.0
209.0
208.0
207.0
206.0(C)
209.7(C)
209.5
209.3(C)
209.3
210.0(C)
209.0(C)
204.8
205.8
204.8
204.7
203.7
203.7
203.6
202.6
207.6
208.6
218.2
218.2
218.5
214.5
213.7
213.2
213.3
213.5
212.5
214.5
211.6
SIGN
BA
HB
T1
T2
T3
T4
R1
R2
TOP OF BANK
EDGE OF WATER
REMOVE EXISTING SCREWGATE AND ABANDON 24" CMP. REMOVE 20 LF OF PIPE, PLUG WITH CONCRETE, AND BACKFILL TRENCH WITH EMBANKMENT FILL
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2)
INSTALL ROCK STREAM BARB
INSTALL BAR IWM (2)
INSTALL LOG STREAM BARB
INSTALL OFF-BANK BRANCH COVER
INSTALL ROOTWAD BANK STRUCTURES- TYPE 1 (2)
INSTALL LOG STREAM BARB
INSTALL LOG STREAM BARB
INSTALL OFF-BANK BRANCH COVER
INSTALL ROOTWAD BANK STRUCTURES TYPE 1 (2)
INSTALL BAR IWM (2)
INSTALL OFF-BANK LOG COVER
INSTALL ROCK STREAM BARB
INSTALL LOG STREAM BARB
INSTALL WATER'S EDGE TREATMENT (85 LF) PLACE STREAMBED FILL ON EXISTING BAR
INSTALL LOG STREAM BARB
INSTALL BAR IWM
INSTALL OFF-BANK BRANCH COVER (2)
INSTALL LOG TOE BANK STRUCTURE (20 LF)
TRANSITION TYPICAL SECTION TO EXISTING SWALE
EXISTING RETAINING WALL
146'-6.625" SOMCL (AO-234)
NOTE: REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS
N
SCALE 1"=20'
0
20
40
60
A
B
C
D
E
F
G
H
1
2
3
4

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	07/17/00
DESIGN	JH/KC
DRAWN	BH/BK/JS
CHECKED	EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

GUADALUPE CREEK RESTORATION PROJECT

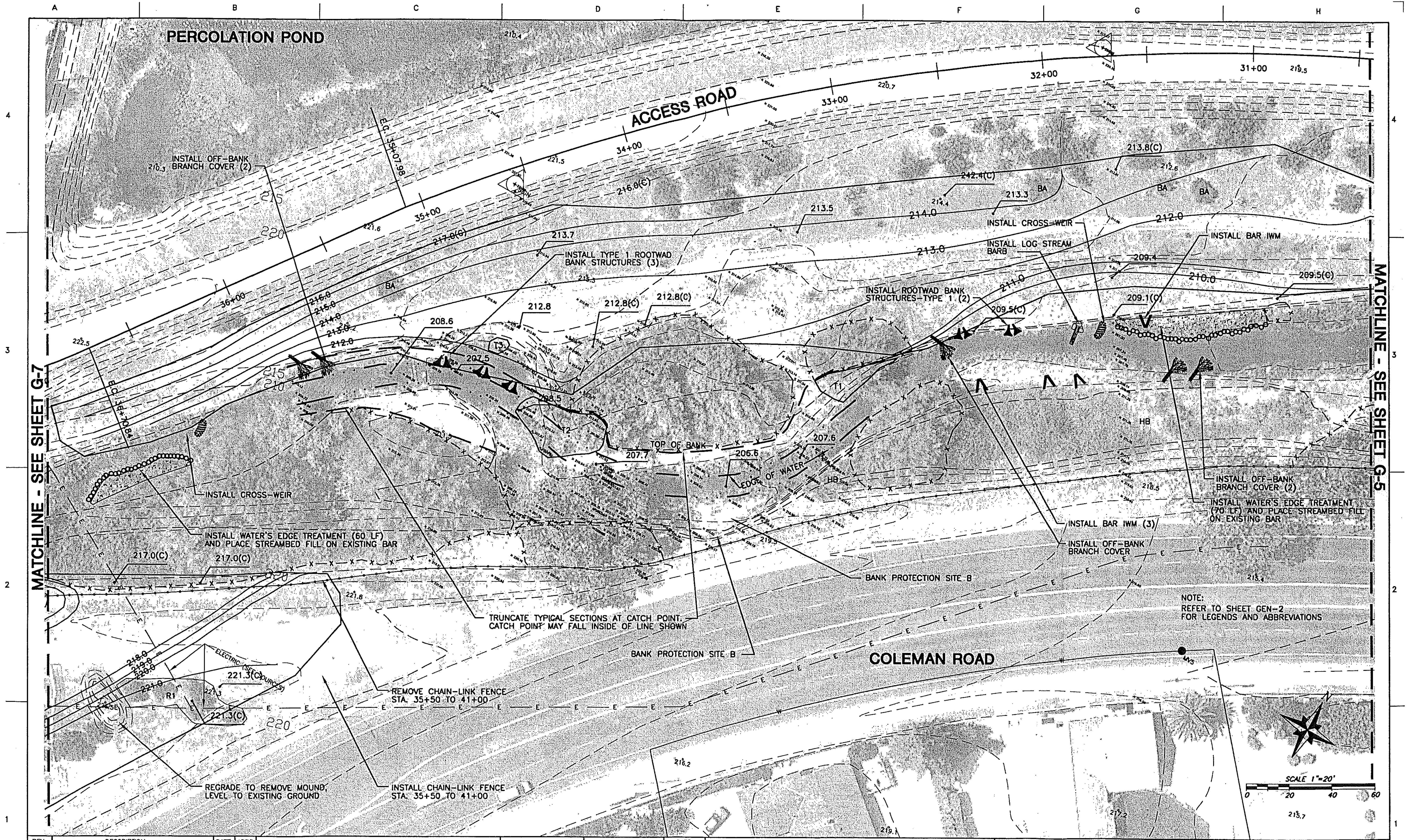
GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET G-5

8 OF 47



PERCOLATION POND
ACCESS ROAD
COLEMAN ROAD
MATCHLINE - SEE SHEET G-7
MATCHLINE - SEE SHEET G-5
EQ. 35+07.98
EQ. 36+70.84
31+00
32+00
33+00
34+00
35+00
36+00
INSTALL OFF-BANK BRANCH COVER (2)
INSTALL TYPE 1 ROOTWAD BANK STRUCTURES (3)
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2)
INSTALL CROSS-WEIR
INSTALL LOG STREAM BARB
INSTALL BAR IWM
INSTALL CROSS-WEIR
INSTALL WATER'S EDGE TREATMENT (60 LF) AND PLACE STREAMBED FILL ON EXISTING BAR
INSTALL OFF-BANK BRANCH COVER (2)
INSTALL WATER'S EDGE TREATMENT (70 LF) AND PLACE STREAMBED FILL ON EXISTING BAR
INSTALL BAR IWM (3)
INSTALL OFF-BANK BRANCH COVER
BANK PROTECTION SITE B
TRUNCATE TYPICAL SECTIONS AT CATCH POINT. CATCH POINT MAY FALL INSIDE OF LINE SHOWN
BANK PROTECTION SITE B
REMOVE CHAIN-LINK FENCE STA. 35+50 TO 41+00
INSTALL CHAIN-LINK FENCE STA. 35+50 TO 41+00
REGRADE TO REMOVE MOUND, LEVEL TO EXISTING GROUND
TOP OF BANK
EDGE OF WATER
ELECTRIC (SEE SOURCES)
NOTE: REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS
SCALE 1"=20'
0 20 40 60
BA
HB
T1
T2
R1
217.0(C)
217.0(C)
216.0(C)
217.0(C)
213.8(C)
242.4(C)
213.3
213.5
213.7
214.0
213.0
212.0
212.8
212.8(C)
212.8(C)
208.6
207.5
208.5
207.7
206.6
207.6
209.5(C)
209.1(C)
209.4
210.0
211.0
209.5(C)
221.3(C)
221.3(C)

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

GUADALUPE CREEK RESTORATION PROJECT

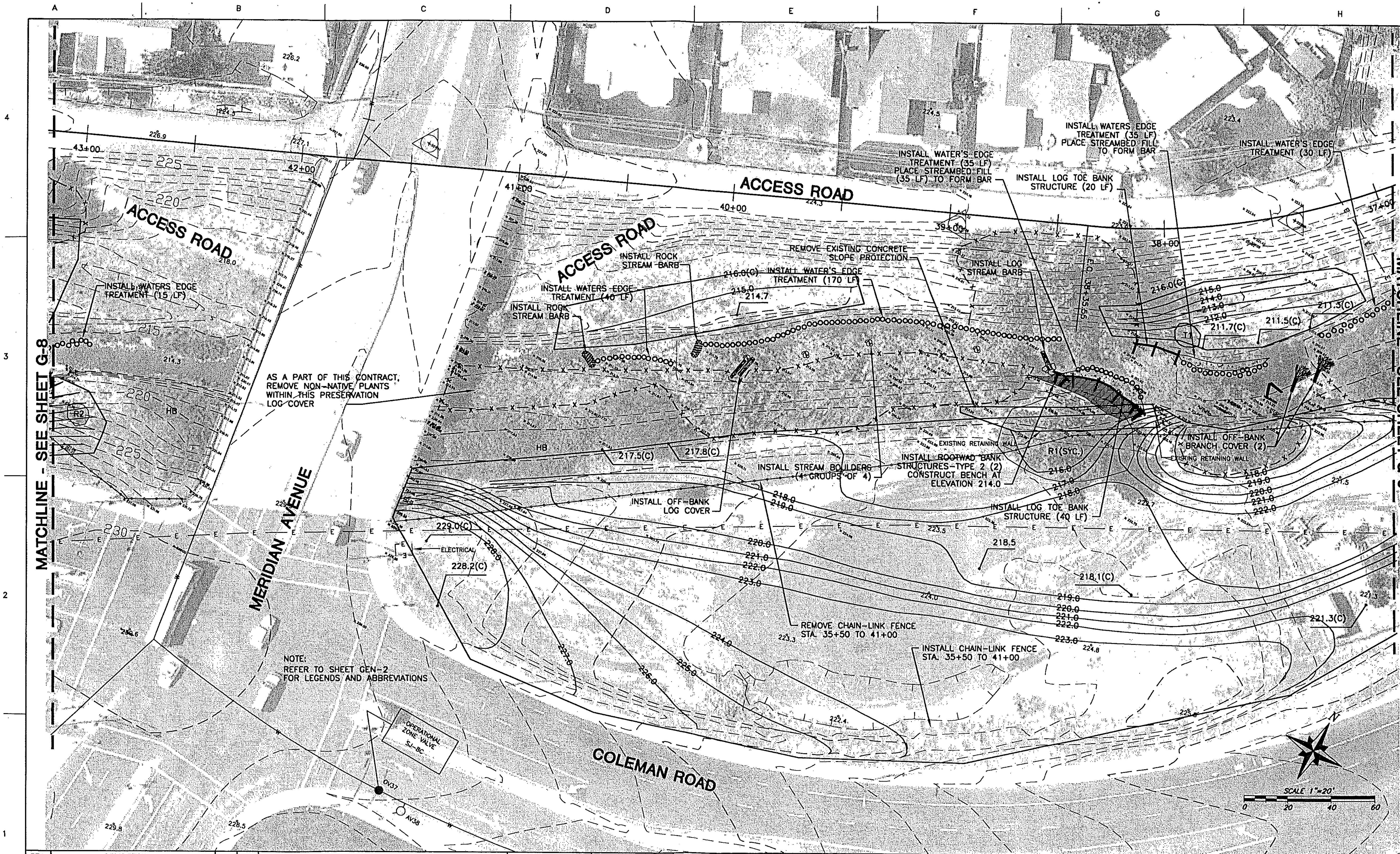
GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET G-6

9 OF 47


MATCHLINE - SEE SHEET G-8
MATCHLINE - SEE SHEET G-6
ACCESS ROAD
ACCESS ROAD
ACCESS ROAD
MERIDIAN AVENUE
COLEMAN ROAD
43+00
42+00
41+00
40+00
39+00
38+00
37+00
E.O. 38+35.55
226.2
224.3
226.9
227.1
224.5
223.4
224.3
225
220
215
220
225
230
218.0
214.3
R2
HB
HB
INSTALL WATERS EDGE TREATMENT (15 LF)
AS A PART OF THIS CONTRACT, REMOVE NON-NATIVE PLANTS WITHIN THIS PRESERVATION LOG COVER
INSTALL ROCK STREAM BARB
INSTALL WATERS EDGE TREATMENT (40 LF)
INSTALL ROCK STREAM BARB
216.0(C)
INSTALL WATER'S EDGE TREATMENT (170 LF)
215.0
214.7
REMOVE EXISTING CONCRETE SLOPE PROTECTION
INSTALL LOG STREAM BARB
INSTALL WATER'S EDGE TREATMENT (35 LF) PLACE STREAMBED FILL (35 LF) TO FORM BAR
INSTALL LOG TOE BANK STRUCTURE (20 LF)
INSTALL WATERS EDGE TREATMENT (35 LF) PLACE STREAMBED FILL TO FORM BAR
INSTALL WATER'S EDGE TREATMENT (30 LF)
216.0(C)
215.0
214.0
213.0
212.0
211.7(C)
211.5(C)
211.3(C)
T1
217.5(C)
217.8(C)
EXISTING RETAINING WALL
INSTALL ROOTWAD BANK STRUCTURES-TYPE 2 (2) CONSTRUCT BENCH AT ELEVATION 214.0
R1(SYC.)
INSTALL OFF-BANK BRANCH COVER (2)
EXISTING RETAINING WALL
INSTALL STREAM BOULDERS (4 GROUPS OF 4)
INSTALL OFF-BANK LOG COVER
216.0
217.0
218.0
INSTALL LOG TOE BANK STRUCTURE (40 LF)
218.0
219.0
220.0
221.0
222.0
221.5
222.7
218.0
219.0
229.0(C)
ELECTRICAL
228.2(C)
228.0
220.0
221.0
222.0
223.0
223.5
218.5
218.1(C)
224.0
219.0
220.0
221.0
222.0
223.0
221.3(C)
REMOVE CHAIN-LINK FENCE STA. 35+50 TO 41+00
INSTALL CHAIN-LINK FENCE STA. 35+50 TO 41+00
223.3
224.0
224.8
227.0
226.0
225.0
222.4
NOTE: REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS
OPERATIONAL ZONE VALVE SJ-BC
AV37
AV38
W
W
229.8
228.5
N
SCALE 1"=20'
0
20
40
60

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, Inc.
3950 Industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

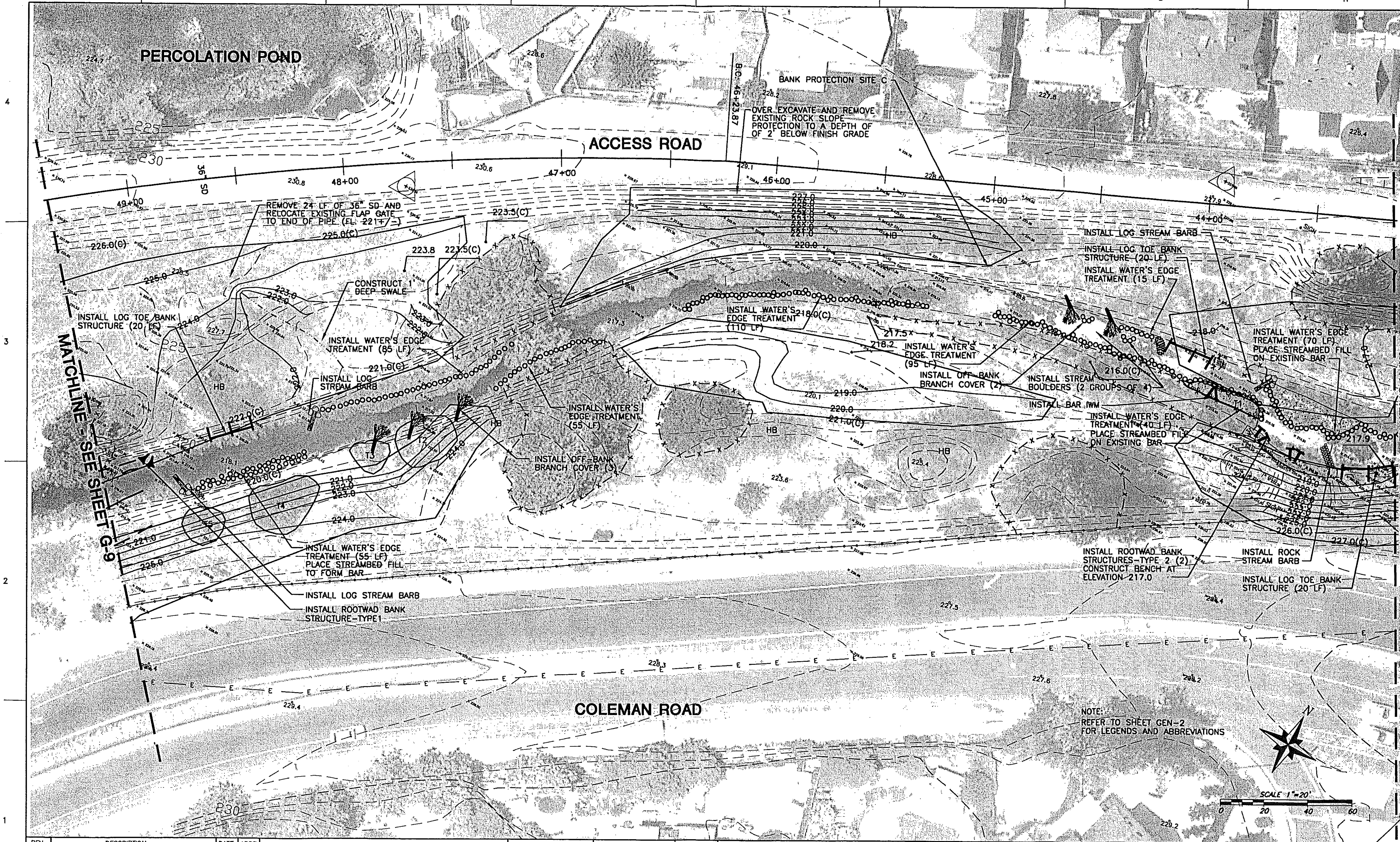
GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
G-7
10 OF 47


PERCOLATION POND
ACCESS ROAD
COLEMAN ROAD
BANK PROTECTION SITE C
B.C. 46+23.87
OVER EXCAVATE AND REMOVE EXISTING ROCK SLOPE PROTECTION TO A DEPTH OF 2' BELOW FINISH GRADE
49+00
48+00
47+00
46+00
45+00
44+00
36" SD
REMOVE 24 LF OF 36" SD AND RELOCATE EXISTING FLAP GATE TO END OF PIPE (FL. 221+/-)
CONSTRUCT 1' DEEP SWALE
INSTALL LOG TOE BANK STRUCTURE (20 LF)
INSTALL WATER'S EDGE TREATMENT (85 LF)
INSTALL LOG STREAM BARB
INSTALL WATER'S EDGE TREATMENT (55 LF)
INSTALL OFF-BANK BRANCH COVER (3)
INSTALL WATER'S EDGE TREATMENT (110 LF)
INSTALL WATER'S EDGE TREATMENT (95 LF)
INSTALL OFF-BANK BRANCH COVER (2)
INSTALL STREAM BOULDERS (2 GROUPS OF 4)
INSTALL BAR IWM
INSTALL WATER'S EDGE TREATMENT (40 LF) PLACE STREAMBED FILL ON EXISTING BAR
INSTALL LOG STREAM BARB
INSTALL LOG TOE BANK STRUCTURE (20 LF)
INSTALL WATER'S EDGE TREATMENT (15 LF)
INSTALL WATER'S EDGE TREATMENT (70 LF) PLACE STREAMBED FILL ON EXISTING BAR
INSTALL WATER'S EDGE TREATMENT (55 LF) PLACE STREAMBED FILL TO FORM BAR
INSTALL LOG STREAM BARB
INSTALL ROOTWAD BANK STRUCTURE-TYPE1
INSTALL ROOTWAD BANK STRUCTURES-TYPE 2 (2) CONSTRUCT BENCH AT ELEVATION 217.0
INSTALL ROCK STREAM BARB
INSTALL LOG TOE BANK STRUCTURE (20 LF)
HB
T3
T4
T5
MATCHLINE - SEE SHEET G-9
MATCHLINE - SEE SHEET G-7
225
230
224.7
228.6
230.6
230.8
229.1
228.6
227.8
226.4
227.9
223.5(C)
225.0(C)
226.0(C)
225.0
224.0
223.0
222.0
223.8
223.5(C)
221.0(C)
222.0(C)
220.0(C)
221.0
222.0
223.0
224.0
225.0
221.0
220.0
218.0(C)
217.5
218.2
216.0(C)
218.0
219.0
220.1
220.0
221.0(C)
217.9
223.4
223.6
226.0(C)
227.0(C)
227.5
228.3
227.6
229.4
229.2
NOTE: REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS
N
SCALE 1"=20'
0
20
40
60

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, Inc.
3950 Industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

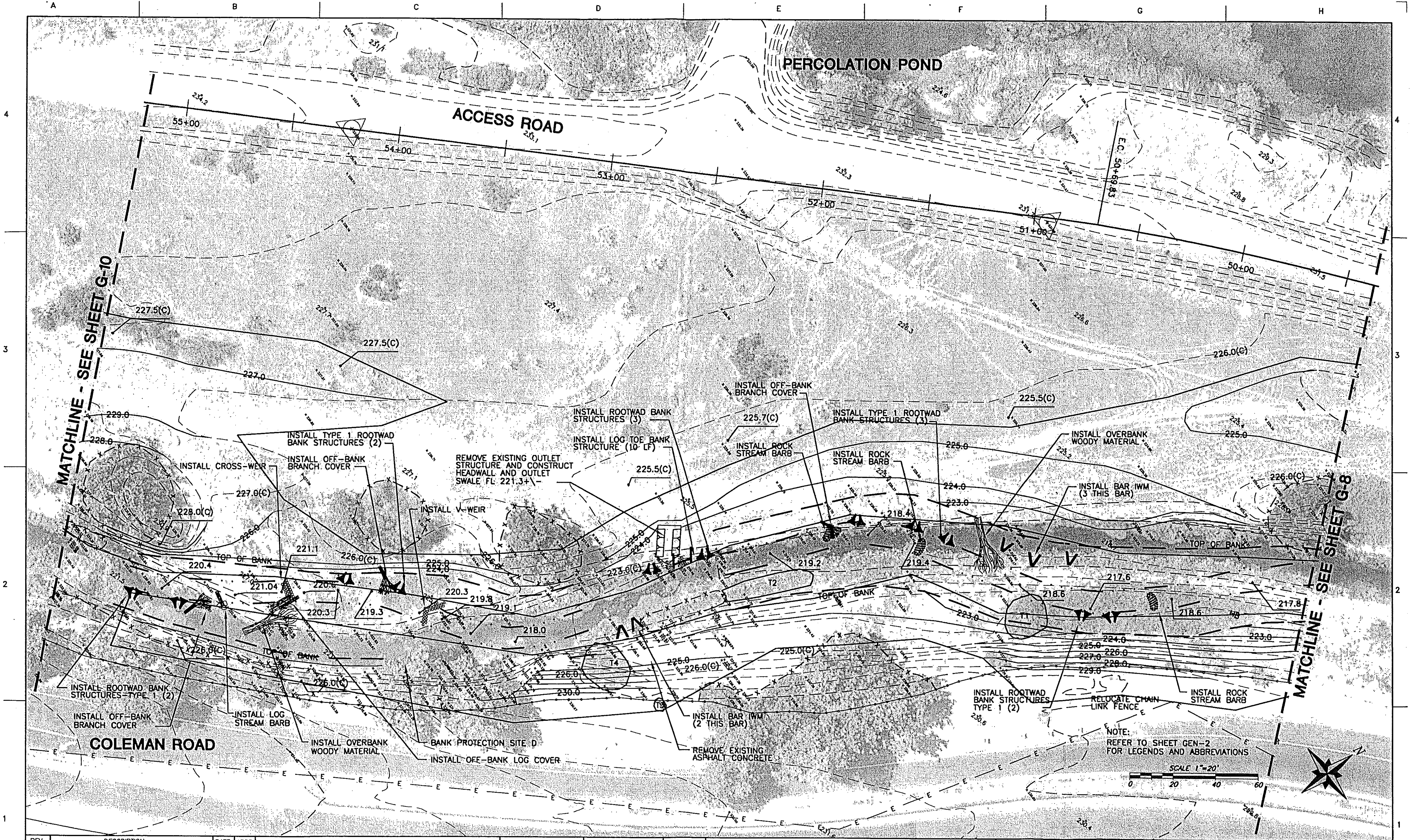
GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
G-8
11 OF 47


PERCOLATION POND
ACCESS ROAD
55+00
54+00
53+00
52+00
51+00
50+00
E.C. 50+69.83
MATCHLINE - SEE SHEET G-10
MATCHLINE - SEE SHEET G-8
COLEMAN ROAD
227.5(C)
227.0
229.0
228.0
227.0(C)
228.0(C)
226.0(C)
225.5(C)
225.7(C)
225.0
224.0
223.0
223.0(C)
221.1
220.4
221.04
220.6
220.3
219.3
219.8
219.1
218.0
219.2
219.4
218.4
217.6
218.6
217.8
225.0(C)
226.0
230.0
229.0
228.0
227.0
TOP OF BANK
T1
T2
T4
T5
INSTALL CROSS-WEIR
INSTALL TYPE 1 ROOTWAD BANK STRUCTURES (2)
INSTALL OFF-BANK BRANCH COVER
INSTALL V-WEIR
REMOVE EXISTING OUTLET STRUCTURE AND CONSTRUCT HEADWALL AND OUTLET SWALE FL 221.3+\-
INSTALL ROOTWAD BANK STRUCTURES (3)
INSTALL LOG TOE BANK STRUCTURE (10 LF)
INSTALL OFF-BANK BRANCH COVER
INSTALL ROCK STREAM BARB
INSTALL TYPE 1 ROOTWAD BANK STRUCTURES (3)
INSTALL ROCK STREAM BARB
INSTALL OVERBANK WOODY MATERIAL
INSTALL BAR IWM (3 THIS BAR)
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2)
INSTALL OFF-BANK BRANCH COVER
INSTALL LOG STREAM BARB
INSTALL OVERBANK WOODY MATERIAL
BANK PROTECTION SITE D
INSTALL OFF-BANK LOG COVER
INSTALL BAR IWM (2 THIS BAR)
REMOVE EXISTING ASPHALT CONCRETE
INSTALL ROOTWAD BANK STRUCTURES TYPE 1 (2)
RELOCATE CHAIN LINK FENCE
INSTALL ROCK STREAM BARB
NOTE: REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS
SCALE 1"=20'
0
20
40
60
N

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

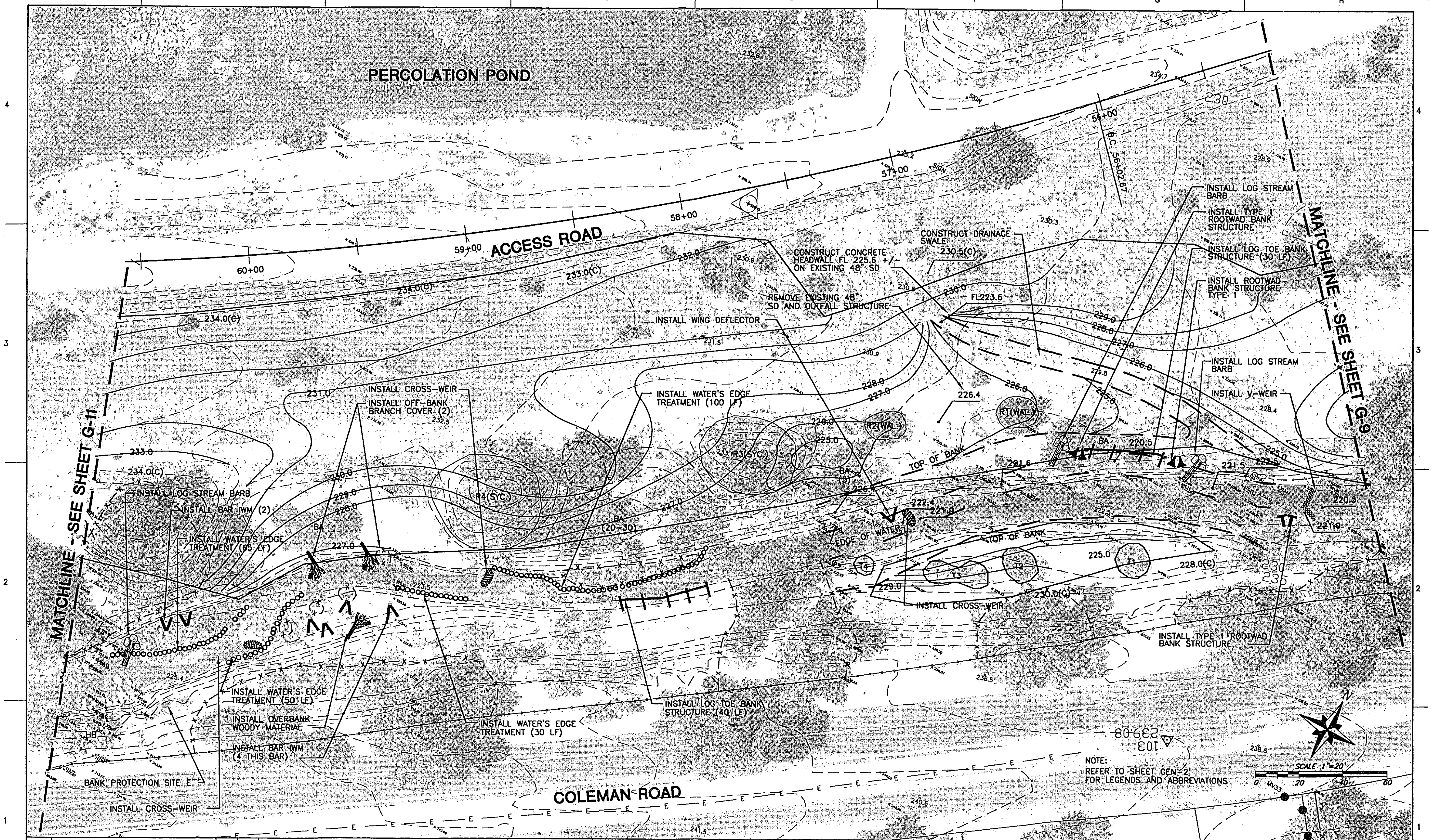
GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
G-9
12 OF 47



PERCOLATION POND
ACCESS ROAD
COLEMAN ROAD
60+00
59+00
58+00
57+00
56+00
B.C. 56+02.67
234.0(C)
233.0(C)
232.0
231.0
233.0
230.5(C)
230.0
FL223.6
229.0
228.0
227.0
226.0
225.0
226.4
220.5
221.5
221.0
222.4
221.8
228.0(C)
230.0(C)
229.0
MATCHLINE - SEE SHEET G-11
MATCHLINE - SEE SHEET G-9
CONSTRUCT DRAINAGE SWALE
CONSTRUCT CONCRETE HEADWALL FL 225.6 +/- ON EXISTING 48" SD
REMOVE EXISTING 48" SD AND OUTFALL STRUCTURE
INSTALL WING DEFLECTOR
INSTALL WATER'S EDGE TREATMENT (100 LF)
INSTALL CROSS-WEIR
INSTALL OFF-BANK BRANCH COVER (2)
INSTALL LOG STREAM BARB
INSTALL TYPE 1 ROOTWAD BANK STRUCTURE
INSTALL LOG TOE BANK STRUCTURE (30 LF)
INSTALL ROOTWAD BANK STRUCTURE TYPE 1
INSTALL LOG STREAM BARB
INSTALL V-WEIR
INSTALL LOG STREAM BARB
INSTALL BAR IWM (2)
INSTALL WATER'S EDGE TREATMENT (65 LF)
INSTALL WATER'S EDGE TREATMENT (50 LF)
INSTALL OVERBANK WOODY MATERIAL
INSTALL BAR IWM (4 THIS BAR)
BANK PROTECTION SITE E
INSTALL CROSS-WEIR
INSTALL WATER'S EDGE TREATMENT (30 LF)
INSTALL LOG TOE BANK STRUCTURE (40 LF)
INSTALL CROSS-WEIR
INSTALL TYPE 1 ROOTWAD BANK STRUCTURE
TOP OF BANK
EDGE OF WATER
TOP OF BANK
R4(SYC)
R3(SYC)
R2(WAL)
R1(WAL)
BA (20-30)
BA (5)
BA
T1
T2
T3
T4
HB
SIGN
N
SCALE 1"=20'
0 20 40 60
NOTE:
REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK RESTORATION PROJECT

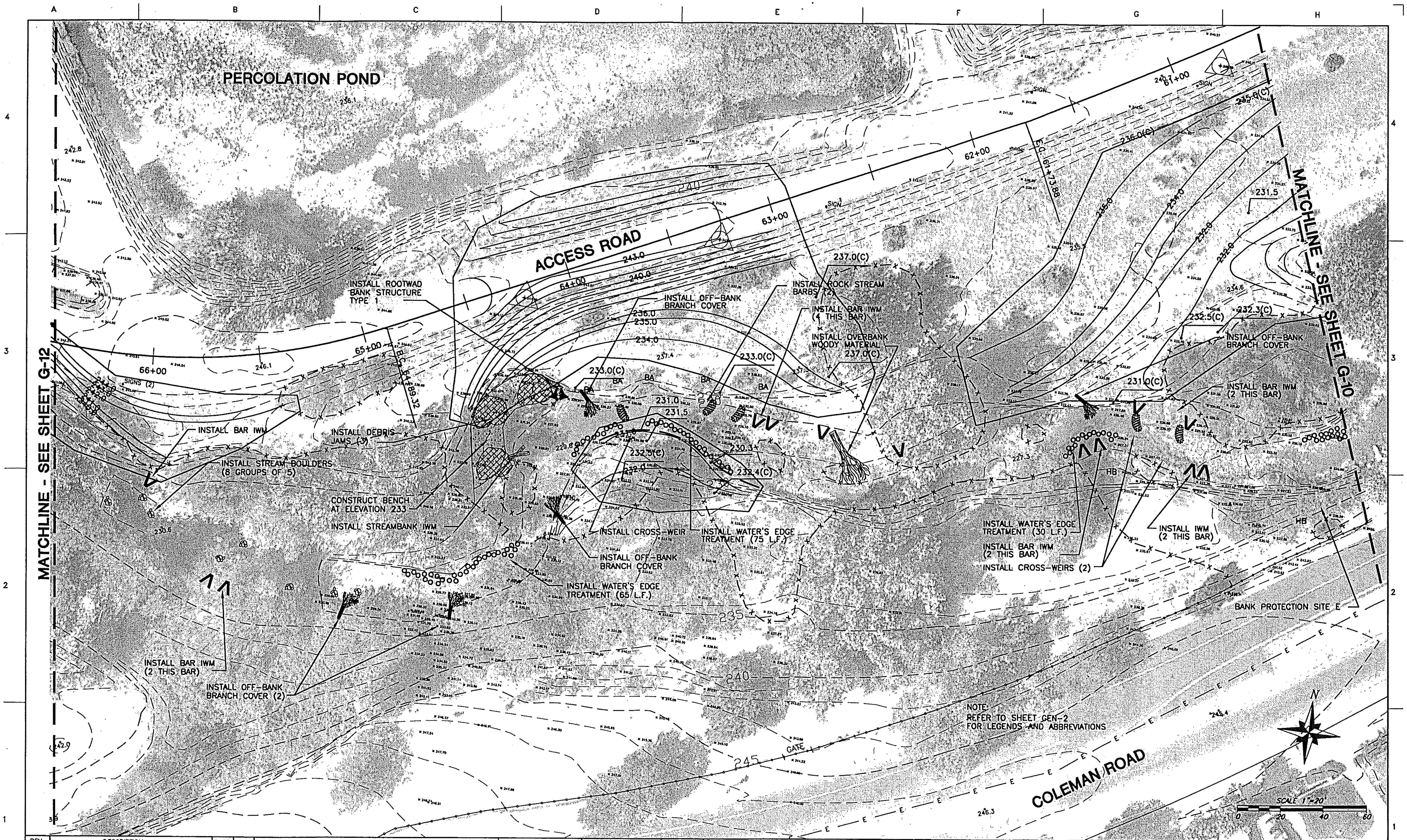
GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET G-10

13 OF 47


PERCOLATION POND
ACCESS ROAD
COLEMAN ROAD
MATCHLINE - SEE SHEET G-12
MATCHLINE - SEE SHEET G-10
61+00
62+00
63+00
64+00
65+00
66+00
EC 61+73.88
BC 64+89.32
SIGN
SIGNS (2)
GATE
INSTALL ROOTWAD BANK STRUCTURE TYPE 1
INSTALL OFF-BANK BRANCH COVER
INSTALL ROCK STREAM BARBS (2)
INSTALL BAR IWM (4 THIS BAR)
INSTALL OVERBANK WOODY MATERIAL
INSTALL BAR IWM
INSTALL DEBRIS JAMS (3)
INSTALL STREAM BOULDERS (8 GROUPS OF 5)
CONSTRUCT BENCH AT ELEVATION 233
INSTALL STREAMBANK IWM
INSTALL CROSS-WEIR
INSTALL OFF-BANK BRANCH COVER
INSTALL WATER'S EDGE TREATMENT (65 L.F.)
INSTALL WATER'S EDGE TREATMENT (75 L.F.)
INSTALL WATER'S EDGE TREATMENT (30 L.F.)
INSTALL BAR IWM (2 THIS BAR)
INSTALL CROSS-WEIRS (2)
INSTALL IWM (2 THIS BAR)
INSTALL OFF-BANK BRANCH COVER
INSTALL BAR IWM (2 THIS BAR)
BANK PROTECTION SITE E
INSTALL BAR IWM (2 THIS BAR)
INSTALL OFF-BANK BRANCH COVER (2)
237.0(C)
237.0(C)
236.0(C)
235.6(C)
233.0(C)
233.0(C)
232.5(C)
232.5(C)
232.3(C)
232.4(C)
231.0(C)
231.0
231.5
230.3
229.8
227.3
234.6
231.5
242.8
246.1
236.1
230.6
242.9
246.3
243.0
240.0
236.0
235.0
234.0
240
235
245
BA
HB
E
N
SCALE 1"=20'
0
20
40
60

NOTE:
REFER TO SHEET GEN-2
FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2850 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

GUADALUPE CREEK RESTORATION PROJECT

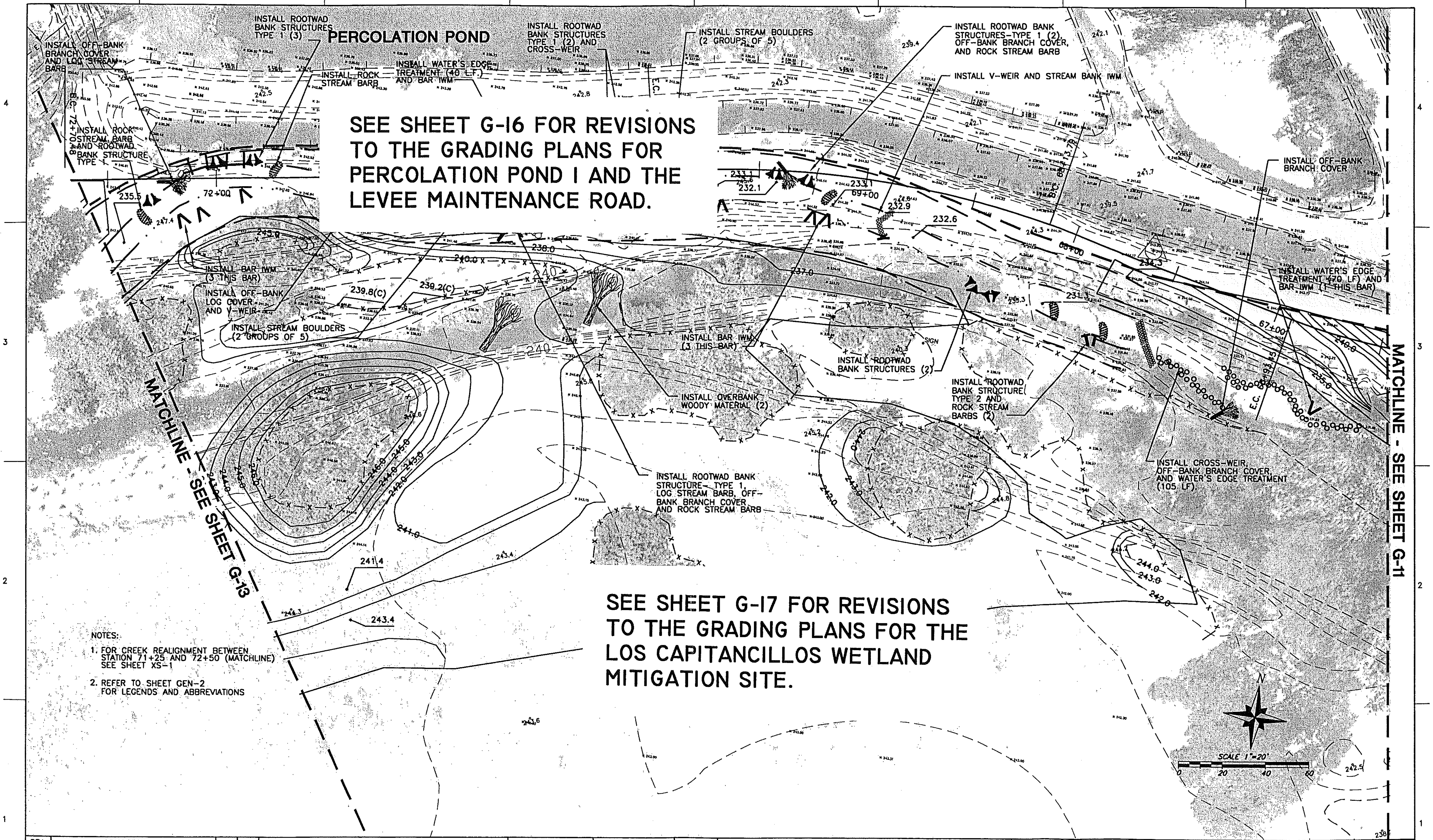
GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET G-11

14 OF 47


A
B
C
D
E
F
G
H
4
3
2
1
PERCOLATION POND
INSTALL OFF-BANK BRANCH COVER AND LOG STREAM BARB
INSTALL ROOTWAD BANK STRUCTURES TYPE 1 (3)
INSTALL ROCK STREAM BARB
INSTALL WATER'S EDGE TREATMENT (40 L.F.) AND BAR IWM
INSTALL ROOTWAD BANK STRUCTURES TYPE 1 (2) AND CROSS-WEIR
INSTALL STREAM BOULDERS (2 GROUPS OF 5)
INSTALL ROOTWAD BANK STRUCTURES-TYPE 1 (2), OFF-BANK BRANCH COVER, AND ROCK STREAM BARB
INSTALL V-WEIR AND STREAM BANK IWM
INSTALL ROCK STREAM BARB AND ROOTWAD BANK STRUCTURE TYPE 1
B.C. 72+70.48
72+00
69+00
68+00
67+00
E.C.
235.5
247.4
242.5
242.3
242.1
241.7
239.4
239.5
233.1
232.1
232.9
232.6
234.3
231.3
240.0
240
238.0
237.0
235.0
239.8(C)
239.2(C)
INSTALL BAR IWM (3 THIS BAR)
INSTALL OFF-BANK LOG COVER AND V-WEIR
INSTALL STREAM BOULDERS (2 GROUPS OF 5)
INSTALL BAR IWM (3 THIS BAR)
INSTALL ROOTWAD BANK STRUCTURES (2)
SIGN
INSTALL OVERBANK WOODY MATERIAL (2)
INSTALL ROOTWAD BANK STRUCTURE TYPE 2 AND ROCK STREAM BARBS (2)
INSTALL OFF-BANK BRANCH COVER
INSTALL WATER'S EDGE TREATMENT (70 LF) AND BAR IWM (1 THIS BAR)
INSTALL CROSS-WEIR, OFF-BANK BRANCH COVER, AND WATER'S EDGE TREATMENT (105 LF)
INSTALL ROOTWAD BANK STRUCTURE- TYPE 1, LOG STREAM BARB, OFF-BANK BRANCH COVER AND ROCK STREAM BARB
245.0
244.0
243.0
242.0
241.0
244.8
245.2
243.4
243.4
241.4
244.3
242.5
238
MATCHLINE - SEE SHEET G-13
MATCHLINE - SEE SHEET G-11
N
SCALE 1"=20'
0
20
40
60

SEE SHEET G-16 FOR REVISIONS TO THE GRADING PLANS FOR PERCOLATION POND I AND THE LEVEE MAINTENANCE ROAD.

SEE SHEET G-17 FOR REVISIONS TO THE GRADING PLANS FOR THE LOS CAPITANCILLOS WETLAND MITIGATION SITE.

NOTES:

1. FOR CREEK REALIGNMENT BETWEEN STATION 71+25 AND 72+50 (MATCHLINE) SEE SHEET XS-1
2. REFER TO SHEET GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

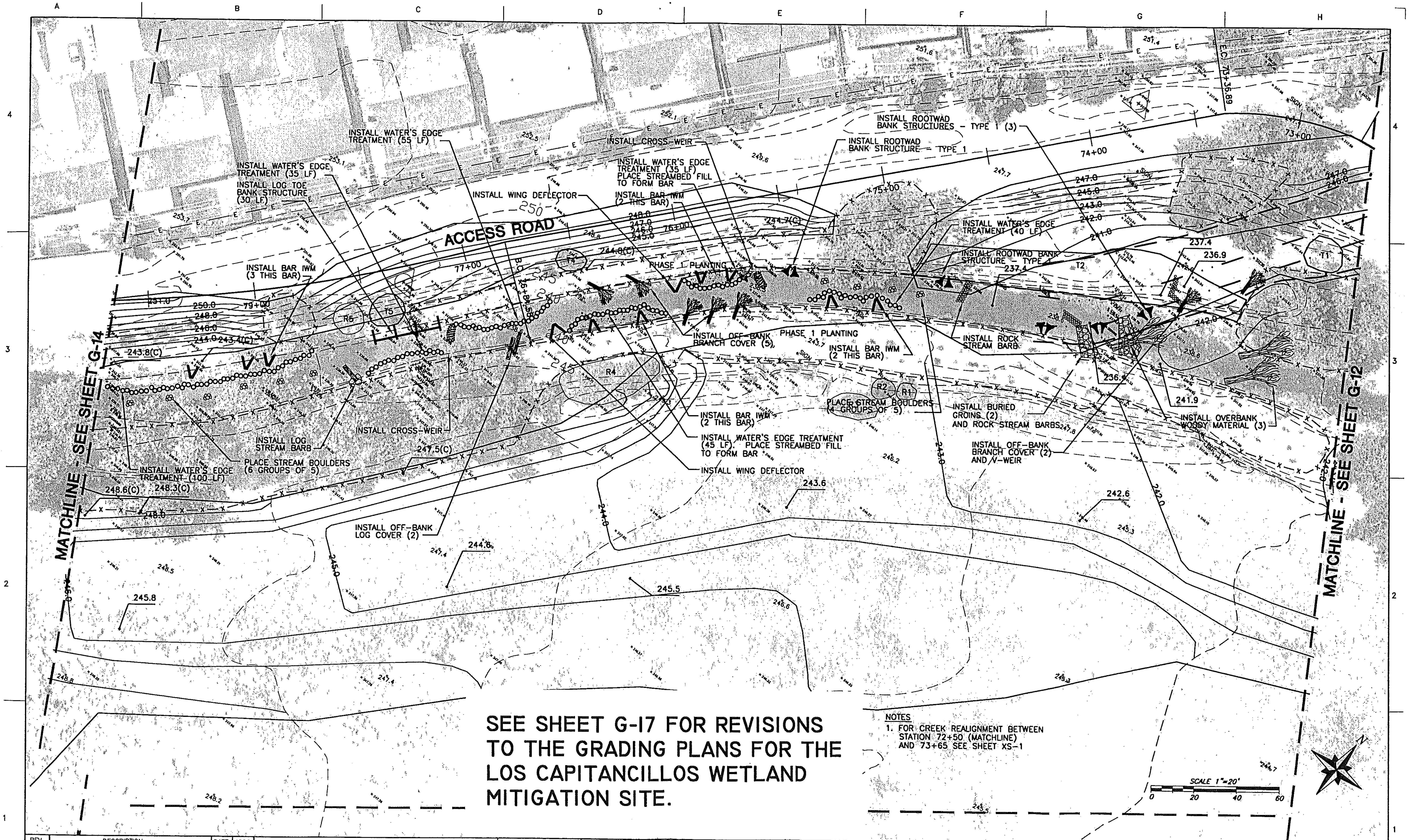
GUADALUPE CREEK
RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
G-12
15 OF 47


INSTALL WATER'S EDGE TREATMENT (55 LF)
INSTALL CROSS-WEIR
INSTALL WATER'S EDGE TREATMENT (35 LF)
INSTALL LOG TOE BANK STRUCTURE (30 LF)
INSTALL WATER'S EDGE TREATMENT (35 LF) PLACE STREAMBED FILL TO FORM BAR
INSTALL WING DEFLECTOR
INSTALL BAR IWM (2 THIS BAR)
INSTALL ROOTWAD BANK STRUCTURES - TYPE 1 (3)
INSTALL ROOTWAD BANK STRUCTURE - TYPE 1
ACCESS ROAD
INSTALL BAR IWM (3 THIS BAR)
PHASE 1 PLANTING
INSTALL WATER'S EDGE TREATMENT (40 LF)
INSTALL ROOTWAD BANK STRUCTURE - TYPE
INSTALL OFF-BANK BRANCH COVER (5)
INSTALL BAR IWM (2 THIS BAR)
INSTALL ROCK STREAM BARB
INSTALL LOG STREAM BARB
INSTALL CROSS-WEIR
PLACE STREAM BOULDERS (6 GROUPS OF 5)
INSTALL WATER'S EDGE TREATMENT (100 LF)
INSTALL BAR IWM (2 THIS BAR)
INSTALL WATER'S EDGE TREATMENT (45 LF). PLACE STREAMBED FILL TO FORM BAR
INSTALL WING DEFLECTOR
PLACE STREAM BOULDERS (4 GROUPS OF 5)
INSTALL BURIED GROINS (2) AND ROCK STREAM BARBS
INSTALL OFF-BANK BRANCH COVER (2) AND V-WEIR
INSTALL OVERBANK WOODY MATERIAL (3)
INSTALL OFF-BANK LOG COVER (2)
MATCHLINE - SEE SHEET G-14
MATCHLINE - SEE SHEET G-12
EC 73+36.89
73+00
74+00
75+00
76+00
77+00
79+00
R1
R2
R4
R5
T1
T2
T4
T5
SIGN
250
245
240
251.0
250.0
248.0
246.0
244.0
243.4(C)
243.8(C)
244.7(C)
244.8(C)
247.5(C)
248.6(C)
248.3(C)
248.0
247.0
245.0
243.0
242.0
241.0
237.4
236.9
236.5
241.9
243.6
242.6
243.3
244.8
247.4
245.5
246.6
245.8
248.5
248.8
247.4
248.2
248.3
245.5
244.7
245.0
244.0
243.0
242.0
251.4
251.6
252.1
252.5
253.1
253.7
249.6
247.7
SCALE 1"=20'
0
20
40
60
N
A
B
C
D
E
F
G
H
1
2
3
4

SEE SHEET G-17 FOR REVISIONS TO THE GRADING PLANS FOR THE LOS CAPITANCILLOS WETLAND MITIGATION SITE.

NOTES

1. FOR CREEK REALIGNMENT BETWEEN STATION 72+50 (MATCHLINE) AND 73+65 SEE SHEET XS-1

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

GUADALUPE CREEK RESTORATION PROJECT

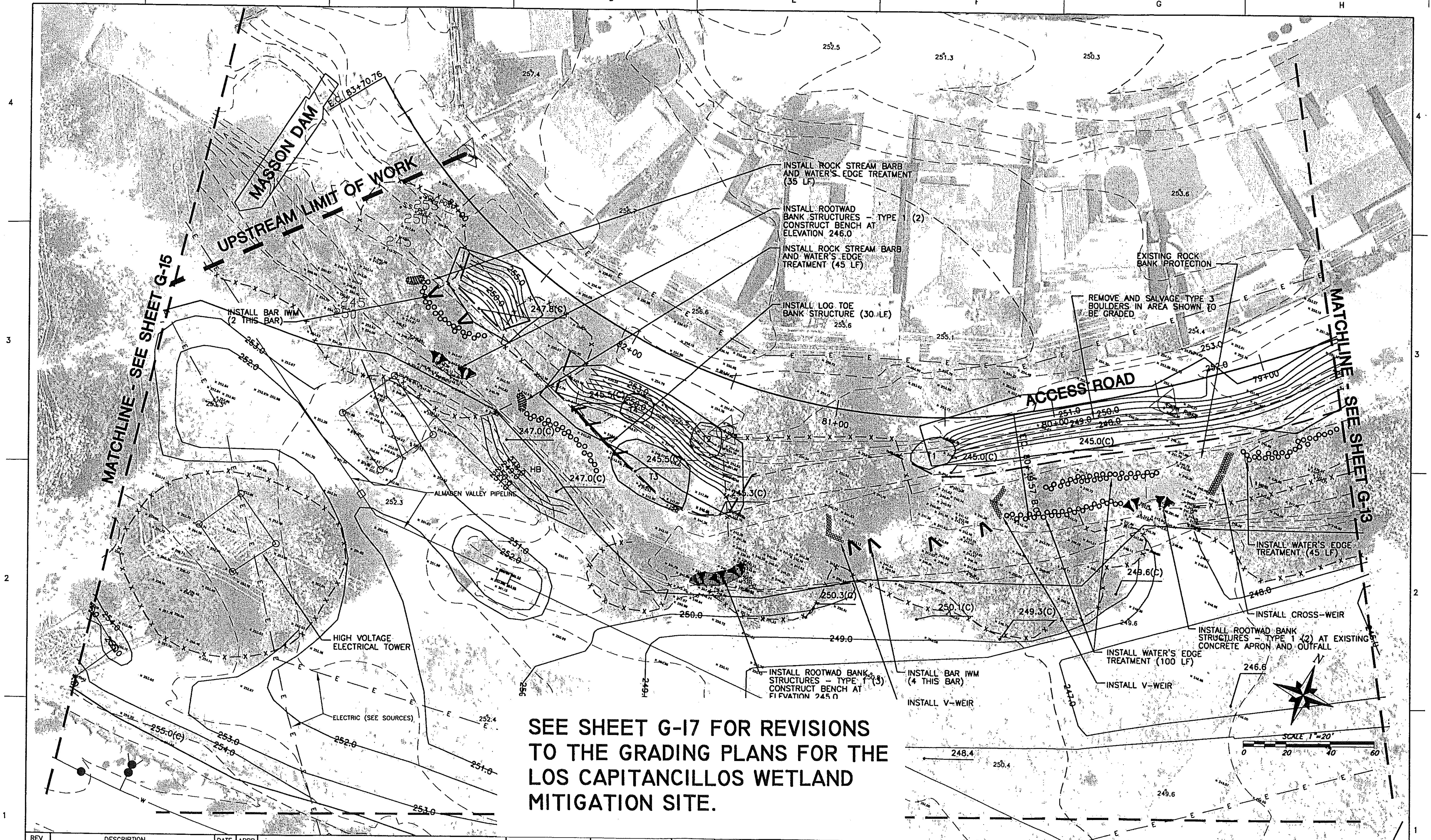
GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET G-13

16 OF 47


MASSON DAM
E.d. 83+70.76
UPSTREAM LIMIT OF WORK
MATCHLINE - SEE SHEET G-15
MATCHLINE - SEE SHEET G-13
INSTALL ROCK STREAM BARB AND WATER'S EDGE TREATMENT (35 LF)
INSTALL ROOTWAD BANK STRUCTURES - TYPE 1 (2) CONSTRUCT BENCH AT ELEVATION 246.0
INSTALL ROCK STREAM BARB AND WATER'S EDGE TREATMENT (45 LF)
INSTALL LOG TOE BANK STRUCTURE (30 LF)
INSTALL BAR IWM (2 THIS BAR)
EXISTING ROCK BANK PROTECTION
REMOVE AND SALVAGE TYPE 3 BOULDERS IN AREA SHOWN TO BE GRADED
ACCESS ROAD
82+00
81+00
80+00
79+00
ALMADEN VALLEY PIPELINE
HIGH VOLTAGE ELECTRICAL TOWER
ELECTRIC (SEE SOURCES)
INSTALL WATER'S EDGE TREATMENT (45 LF)
INSTALL CROSS-WEIR
INSTALL ROOTWAD BANK STRUCTURES - TYPE 1 (2) AT EXISTING CONCRETE APRON AND OUTFALL
INSTALL WATER'S EDGE TREATMENT (100 LF)
INSTALL V-WEIR
INSTALL ROOTWAD BANK STRUCTURES - TYPE 1 (3) CONSTRUCT BENCH AT ELEVATION 245.0
INSTALL BAR IWM (4 THIS BAR)
INSTALL V-WEIR
HB
T3
252.5
251.3
250.3
253.6
247.8(C)
247.0(C)
245.5(C)
245.0(C)
245.3(C)
249.6(C)
249.3(C)
250.3(C)
250.1(C)
255.0(C)
248.0
248.4
246.6
249.0
250.0
251.0
252.0
253.0
254.0
N
SCALE 1"=20'
0
20
40
60

SEE SHEET G-17 FOR REVISIONS TO THE GRADING PLANS FOR THE LOS CAPITANCILLOS WETLAND MITIGATION SITE.

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK RESTORATION PROJECT

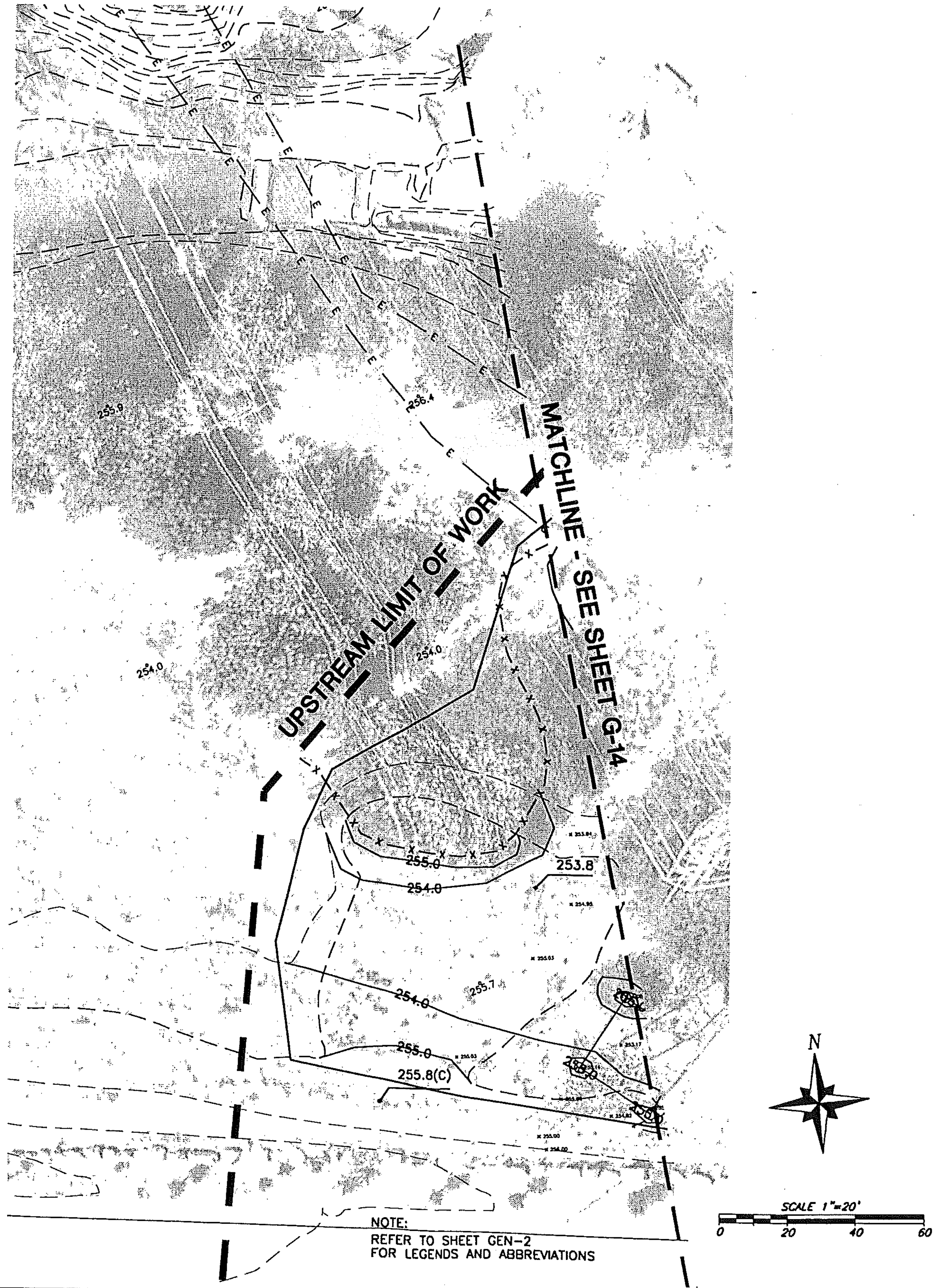
GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET G-14

17 OF 47



NOTE:
REFER TO SHEET GEN-2
FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/BK/JS
CHECKED EW/JZ

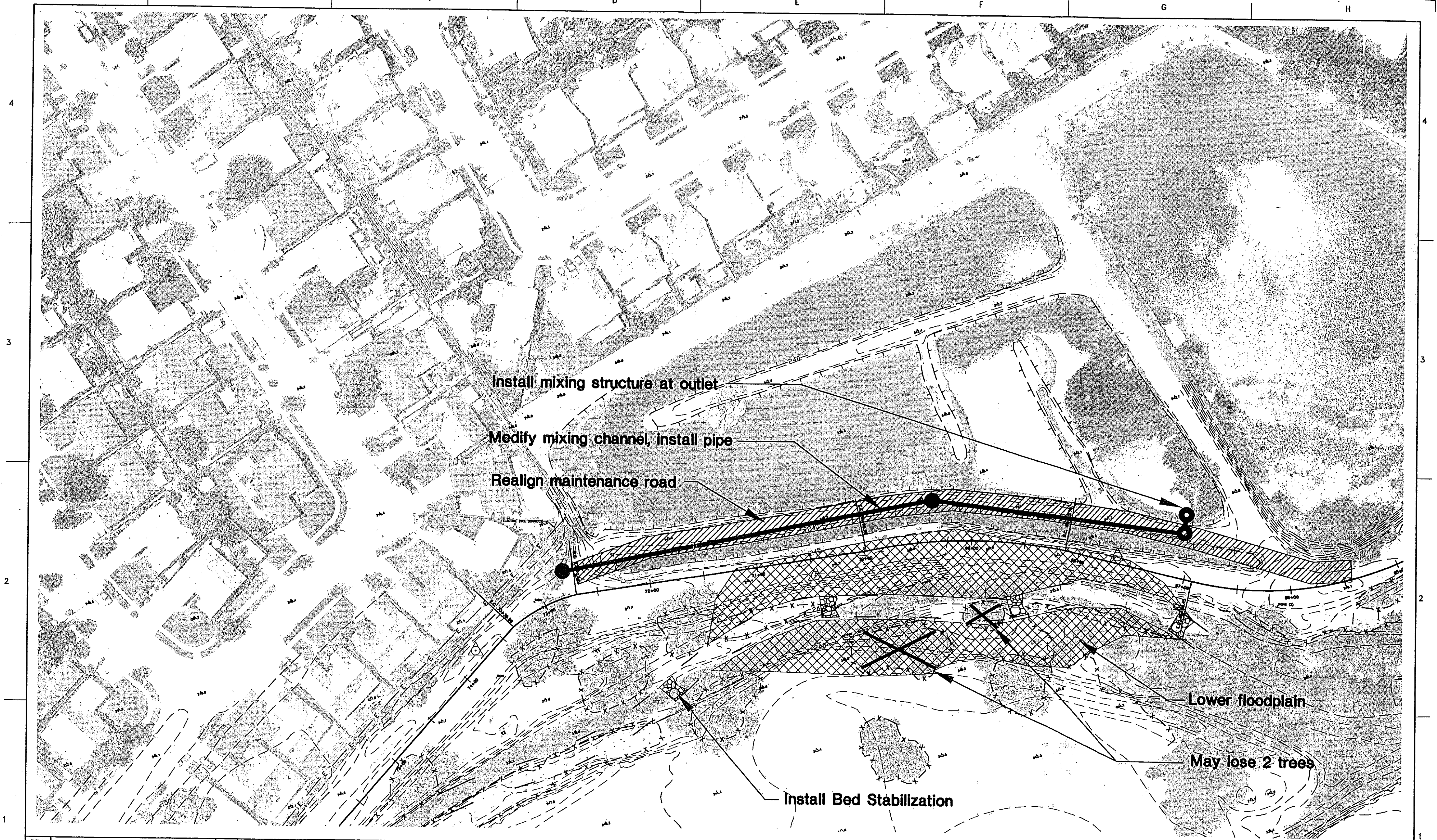
Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK RESTORATION PROJECT

GRADING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN
SHEET
G-15
18 OF 47


Install mixing structure at outlet
Modify mixing channel, install pipe
Realign maintenance road
Lower floodplain
May lose 2 trees
Install Bed Stabilization
240
250
A
B
C
D
E
F
G
H
1
2
3
4

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	09/13/00
DESIGN	or/ew
DRAWN	of
CHECKED	-

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

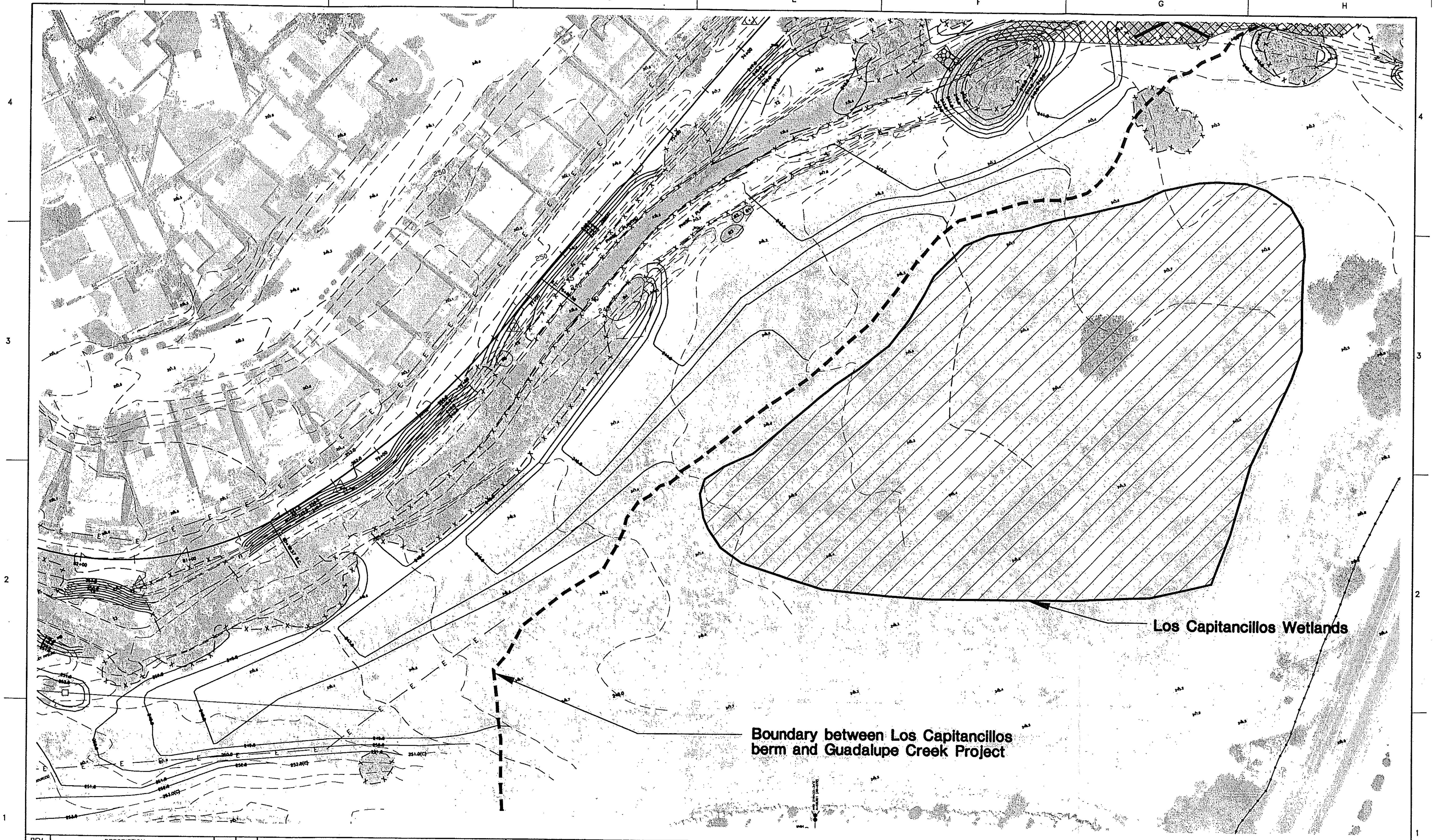
Refined Channel Alignment at Pond 1

Conceptual Plan

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
1"=80'

SHEET
G-16


Los Capitancillos Wetlands
Boundary between Los Capitancillos berm and Guadalupe Creek Project
250

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	09/13/00
DESIGN	ar/ew
DRAWN	of
CHECKED	–

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

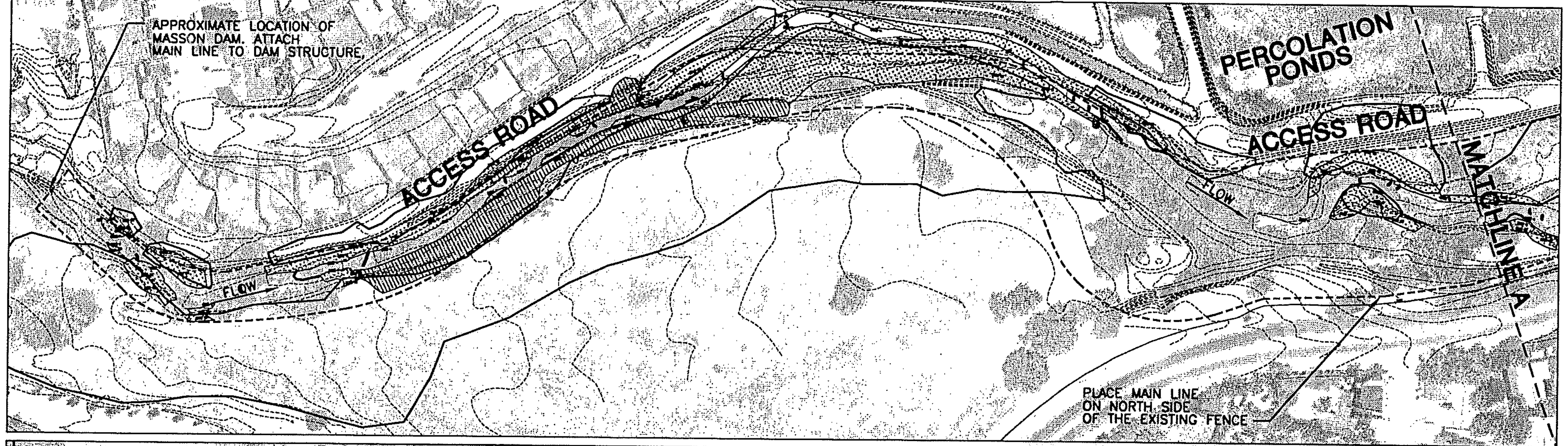
Refined Grading Plan for Los Capitancillos

Conceptual Grading Plan

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
1"=80'

SHEET
G-17

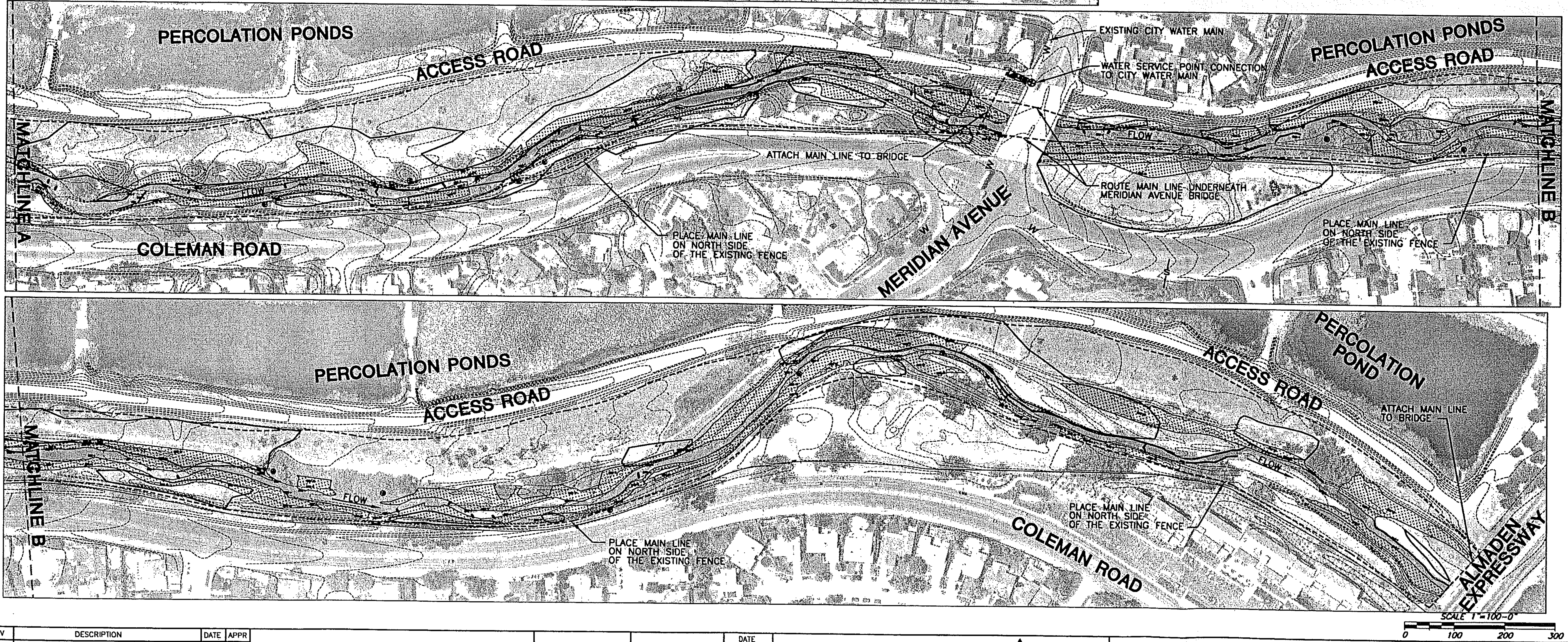

APPROXIMATE LOCATION OF MASSON DAM. ATTACH MAIN LINE TO DAM STRUCTURE.
ACCESS ROAD
FLOW
PERCOLATION PONDS
ACCESS ROAD
FLOW
MATCHLINE A
PLACE MAIN LINE ON NORTH SIDE OF THE EXISTING FENCE

IRRIGATION LEGEND

SYMBOL	DESCRIPTION
⊕	WATER SERVICE POINT
⋈	SHUT OFF VALVE
◩	BACK FLOW ASSEMBLY
M	METER
------	MAIN LINE
▨	EXISTING REVEGETATION PLANTINGS TO BE IRRIGATED
░	CONTAINER PLANTS AND TRANSPLANTS TO BE IRRIGATED

NOTES:

1. IRRIGATION EQUIPMENT IS SHOWN PARTIALLY DIAGRAMMATIC FOR GRAPHIC CLARITY.
2. PLANTING AREAS SHOWN ARE APPROXIMATE. VERIFY PLANT AREAS WITH THE PLANTING PLANS AND VERIFY EXACT LOCATIONS IN THE FIELD.
3. PLACE MAIN LINE AT THE TOP OF BANK WHENEVER POSSIBLE.


PERCOLATION PONDS
ACCESS ROAD
MATCHLINE A
FLOW
COLEMAN ROAD
PLACE MAIN LINE ON NORTH SIDE OF THE EXISTING FENCE
ATTACH MAIN LINE TO BRIDGE
MERIDIAN AVENUE
EXISTING CITY WATER MAIN
WATER SERVICE POINT CONNECTION TO CITY WATER MAIN
ROUTE MAIN LINE UNDERNEATH MERIDIAN AVENUE BRIDGE
PERCOLATION PONDS
ACCESS ROAD
FLOW
PLACE MAIN LINE ON NORTH SIDE OF THE EXISTING FENCE
MATCHLINE B
MATCHLINE B
PERCOLATION PONDS
ACCESS ROAD
FLOW
PLACE MAIN LINE ON NORTH SIDE OF THE EXISTING FENCE
PERCOLATION POND
ACCESS ROAD
ATTACH MAIN LINE TO BRIDGE
FLOW
PLACE MAIN LINE ON NORTH SIDE OF THE EXISTING FENCE
COLEMAN ROAD
ALMADEN EXPRESSWAY
SCALE 1"=100-0"
0
100
200
300

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AF/JZ
DRAWN BK
CHECKED JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

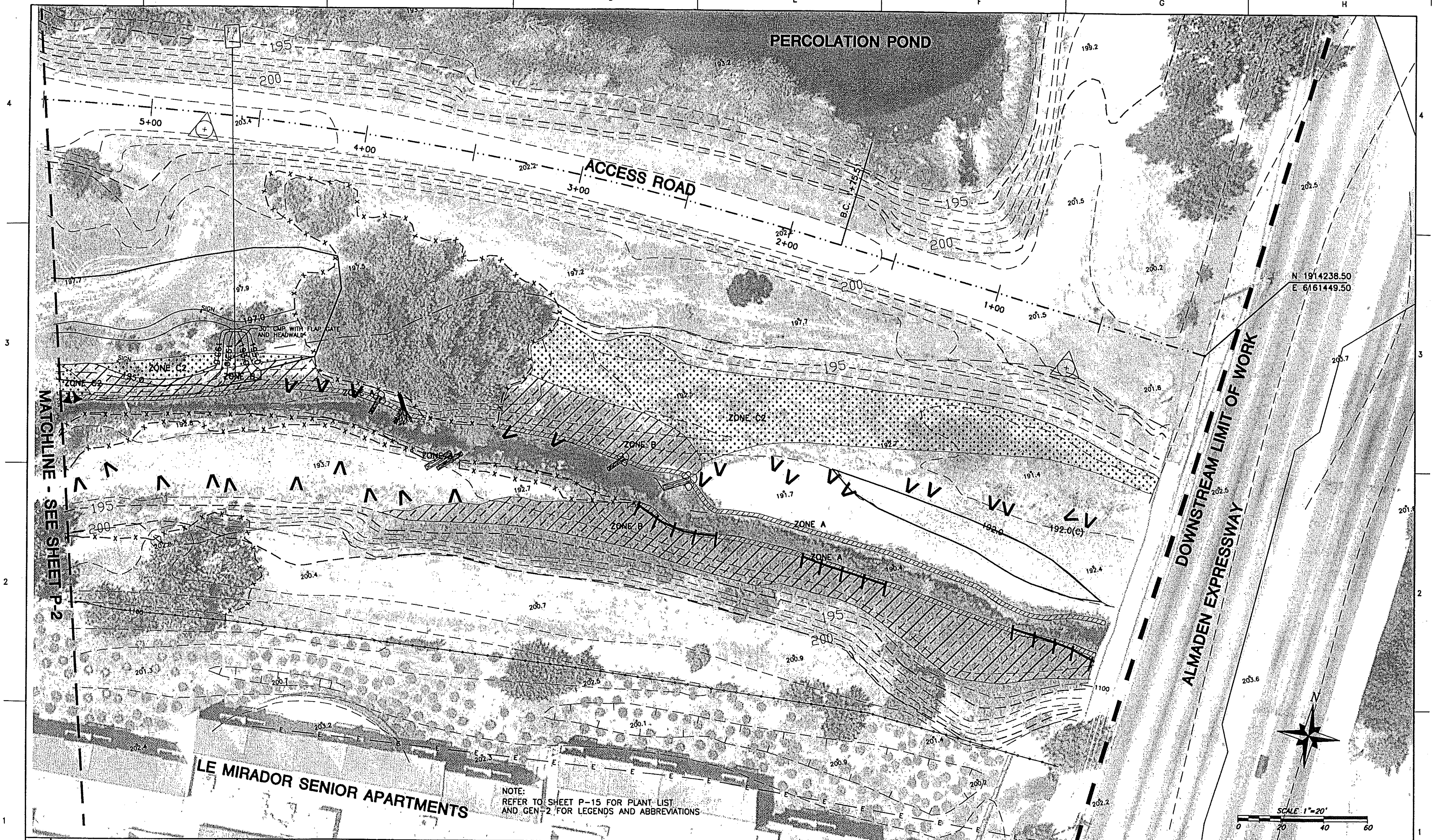
GUADALUPE CREEK RESTORATION PROJECT

SCHEMATIC IRRIGATION PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
I-1
22 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

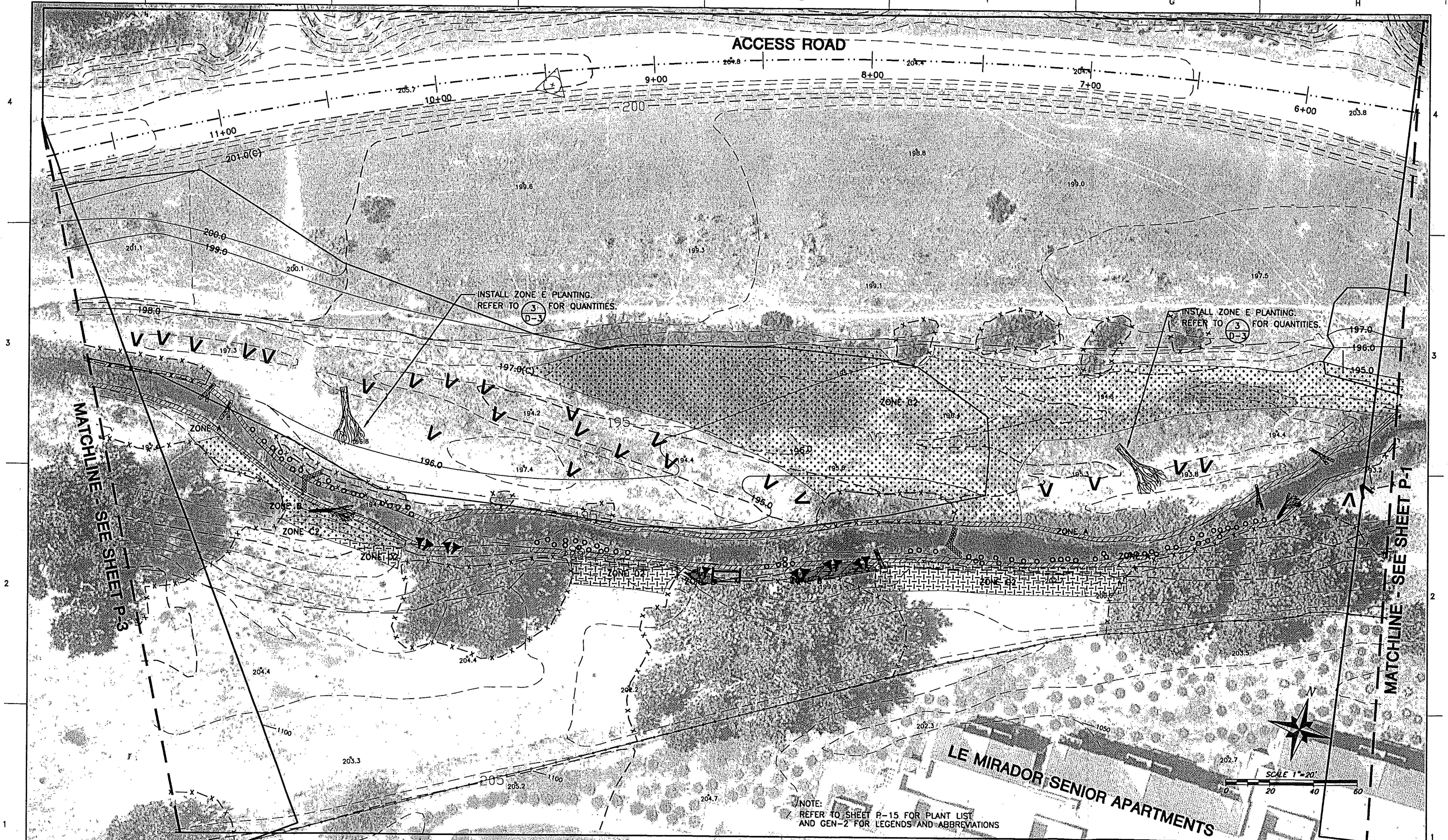
DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT
PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN
SHEET
P-1
23 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

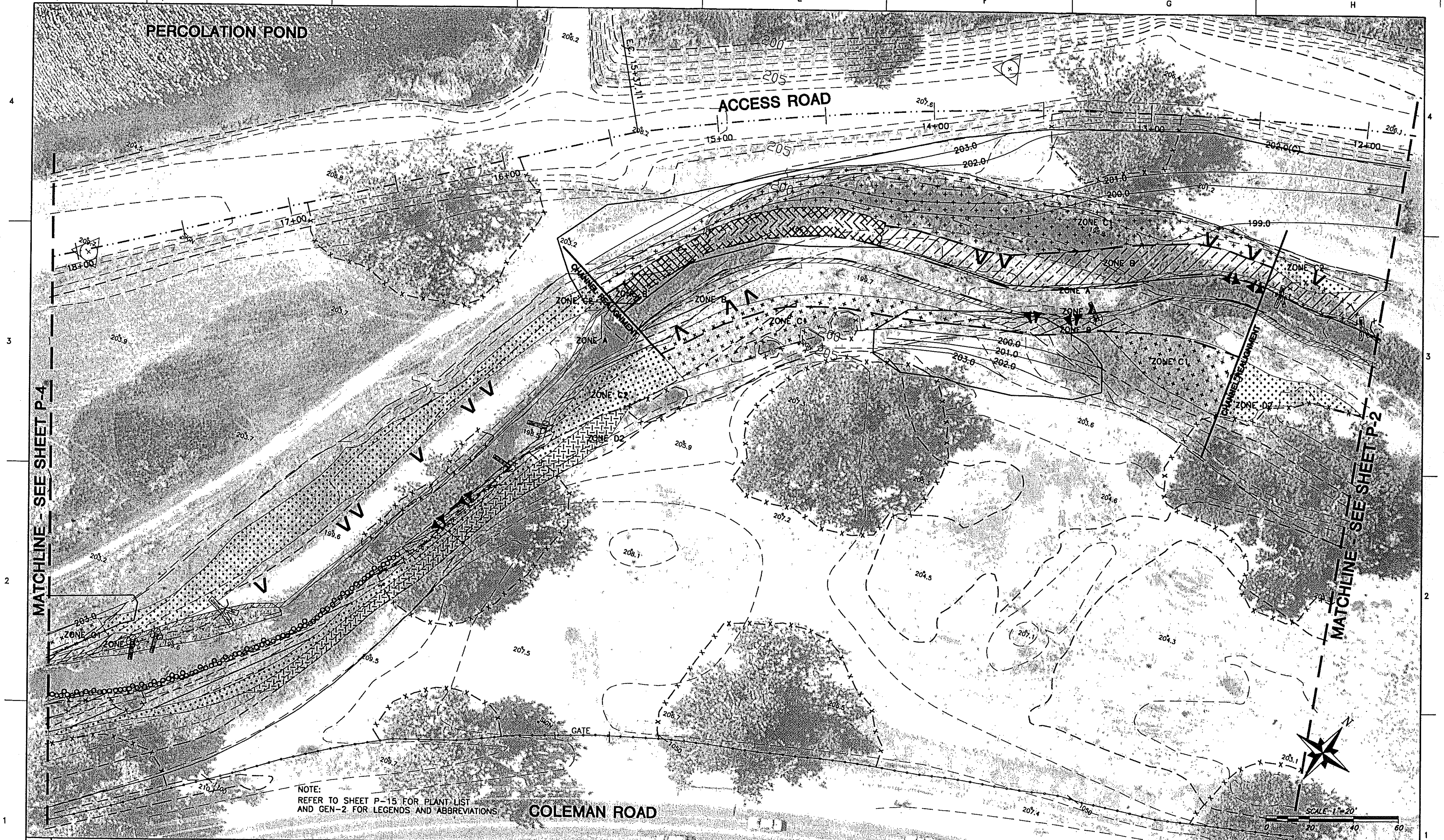
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-2
24 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 Industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	07/17/00
DESIGN	AR/JB
DRAWN	BH/CJ/BK
CHECKED	EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

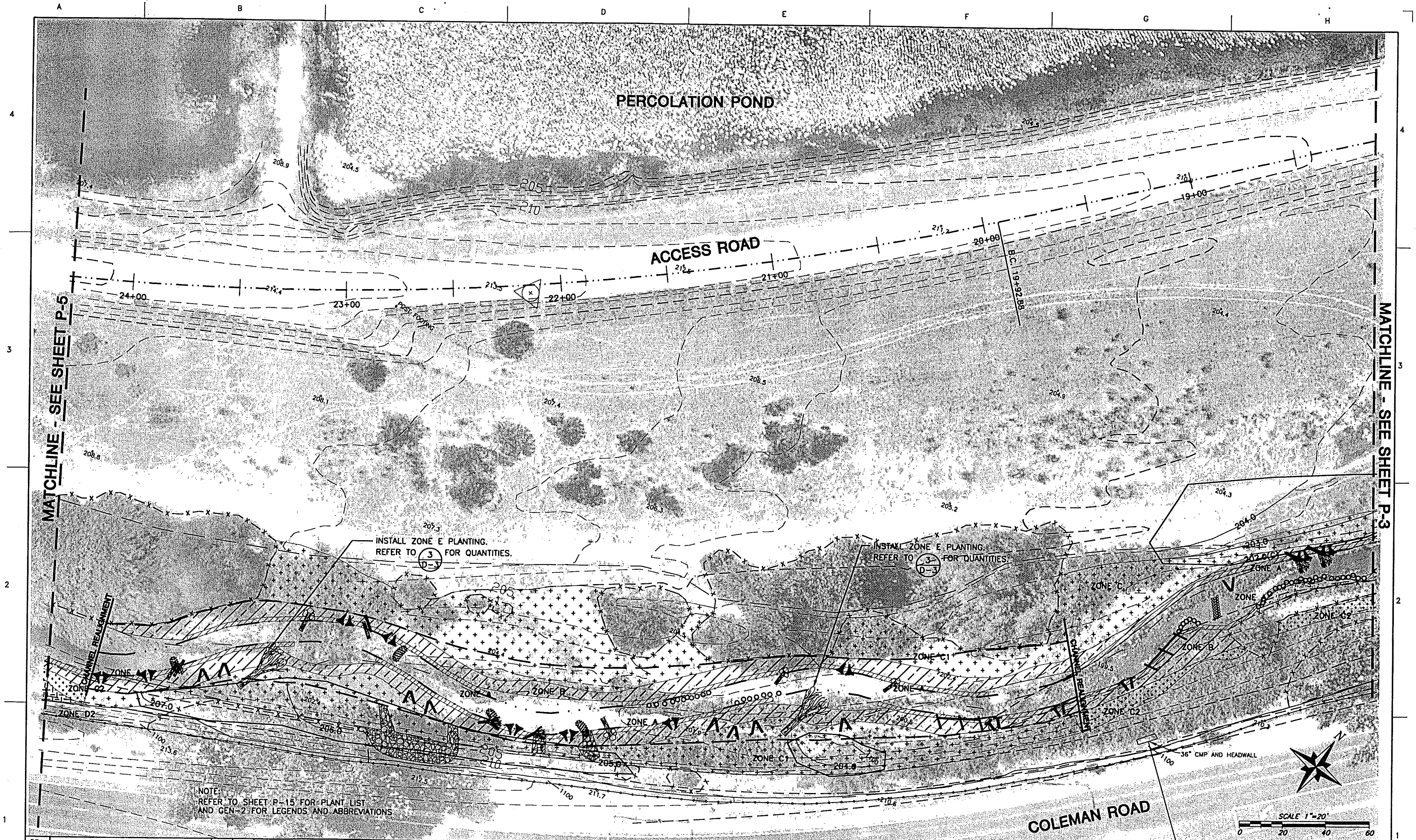
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-3
25 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

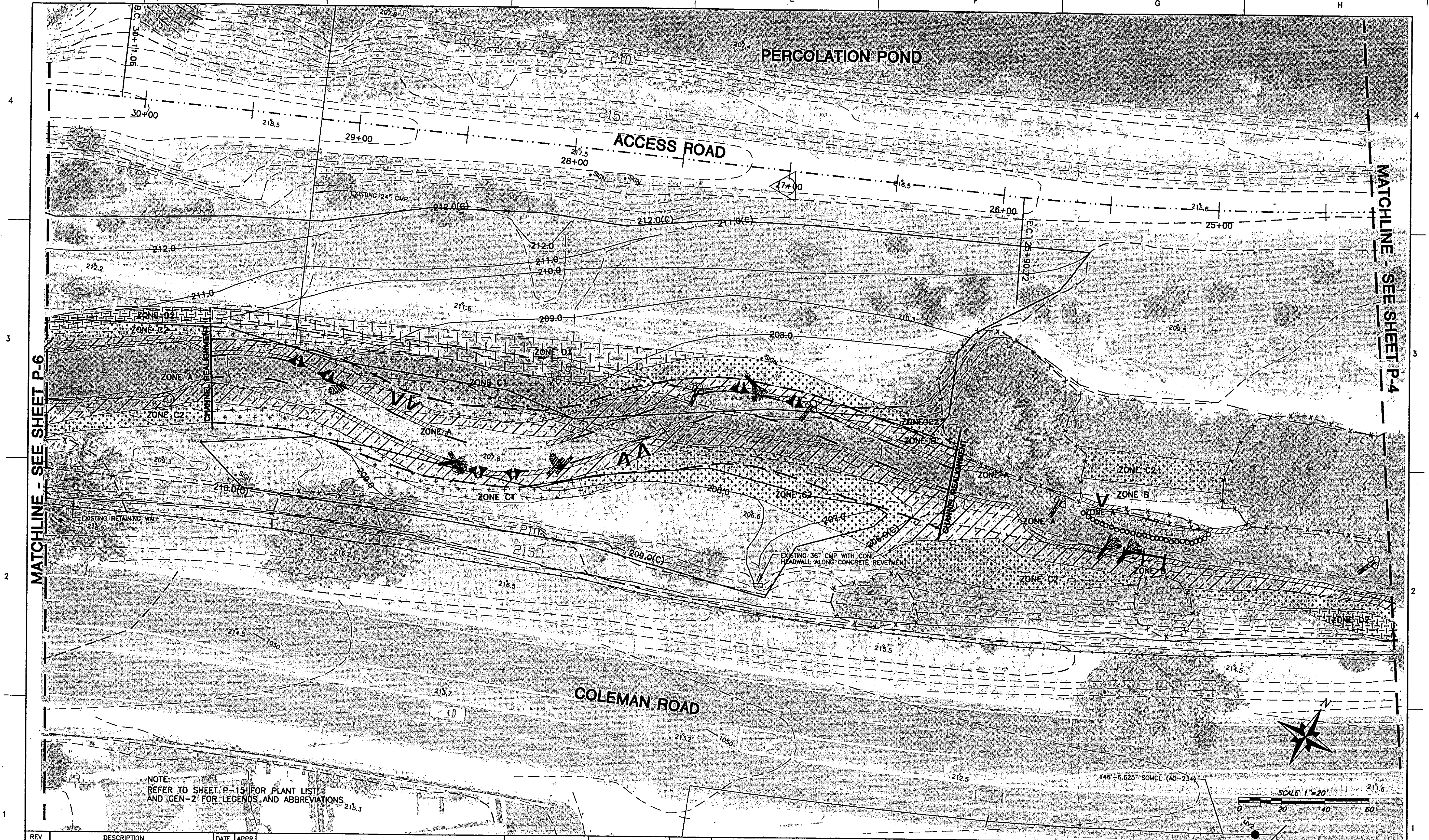
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
P-4
26 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

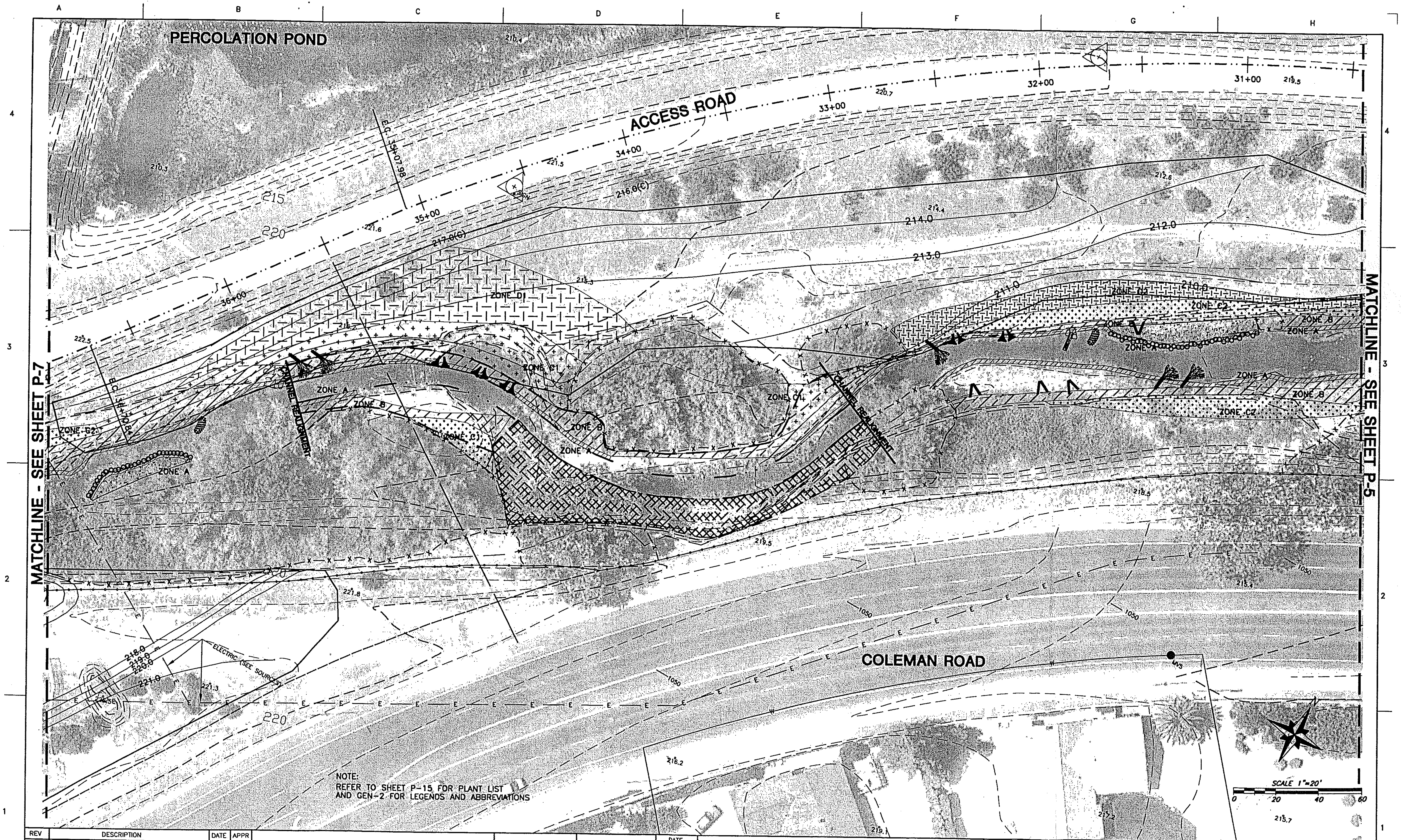
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-5
27 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

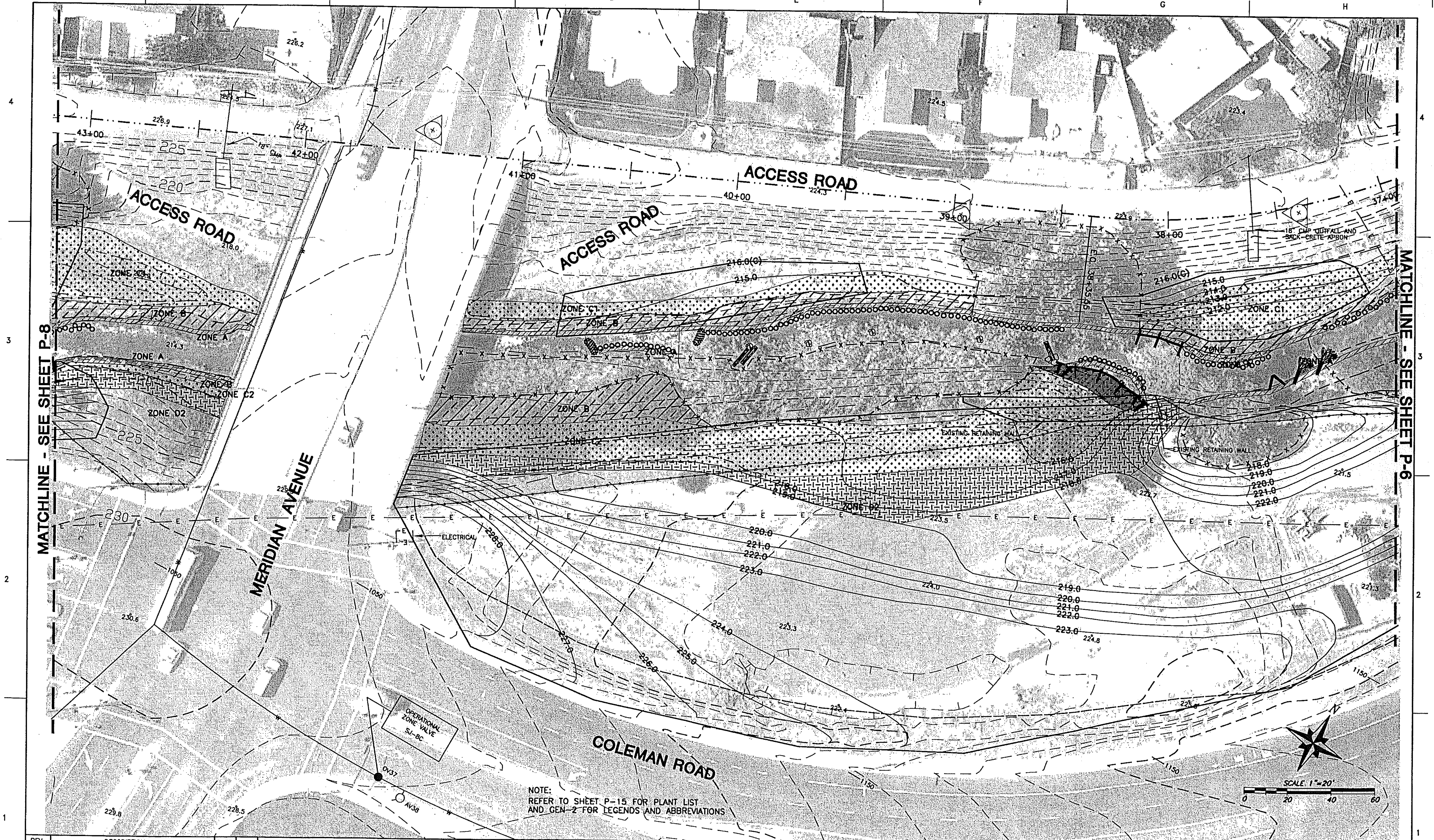
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
P-6
28 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	07/17/00
DESIGN	AR/JB
DRAWN	BH/CJ/BK
CHECKED	EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

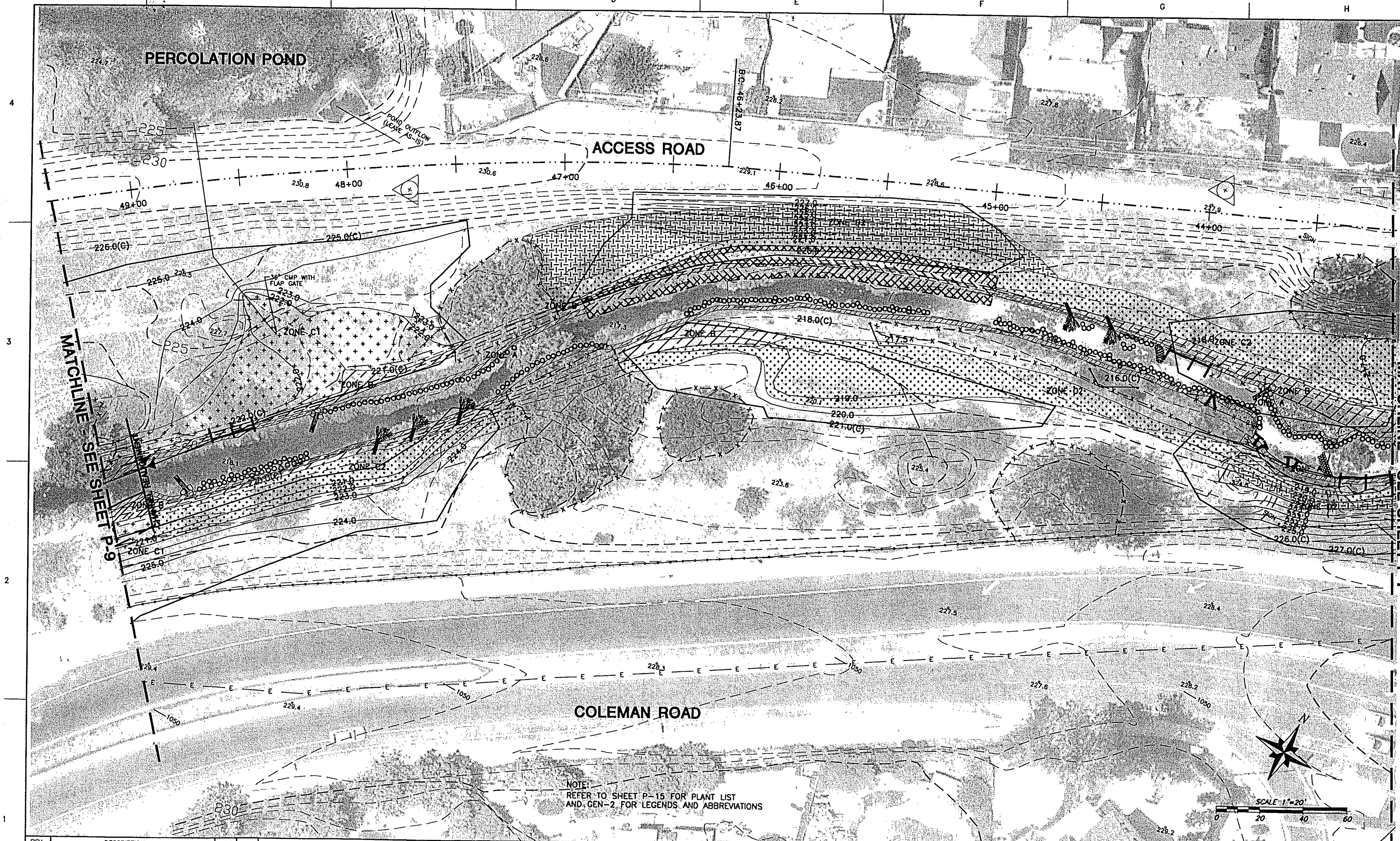
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-7
29 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2850 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

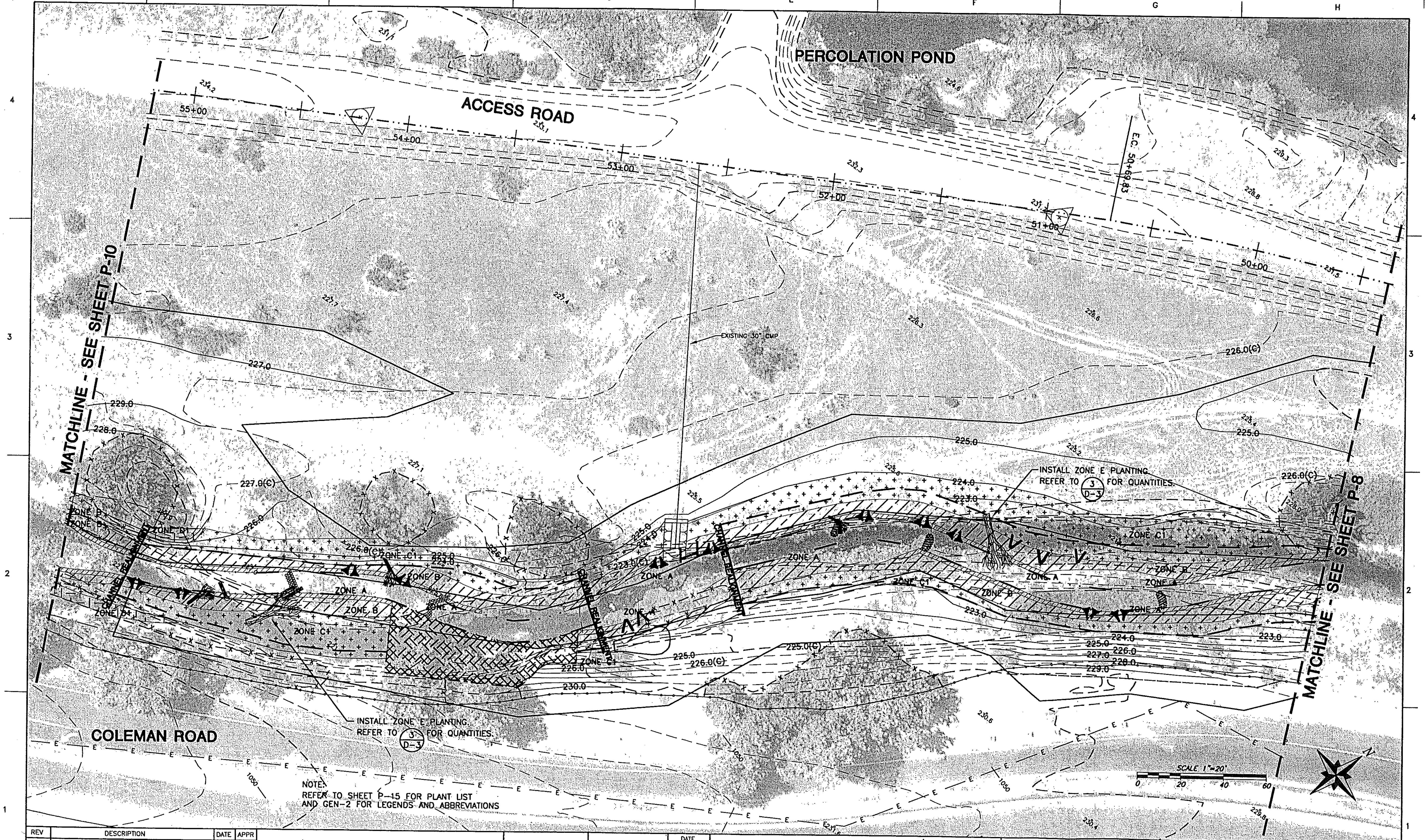
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-8
30 OF 47



INSTALL ZONE E PLANTING. REFER TO 3/D-3 FOR QUANTITIES.

INSTALL ZONE E PLANTING. REFER TO 3/D-3 FOR QUANTITIES.

NOTE:
REFER TO SHEET P-15 FOR PLANT LIST AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

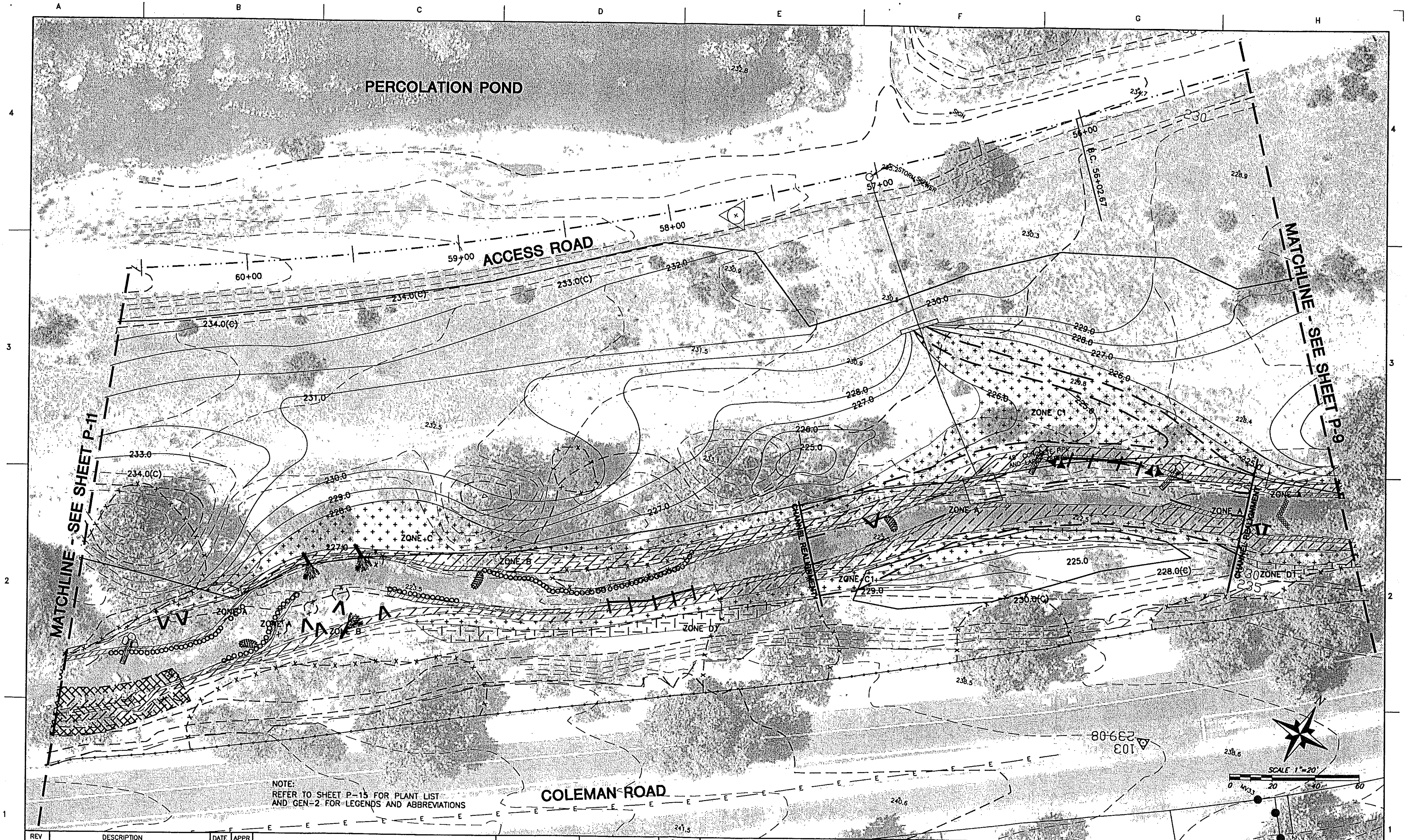
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
P-9
31 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	07/17/00
DESIGN	AR/JB
DRAWN	BH/CJ/BK
CHECKED	EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

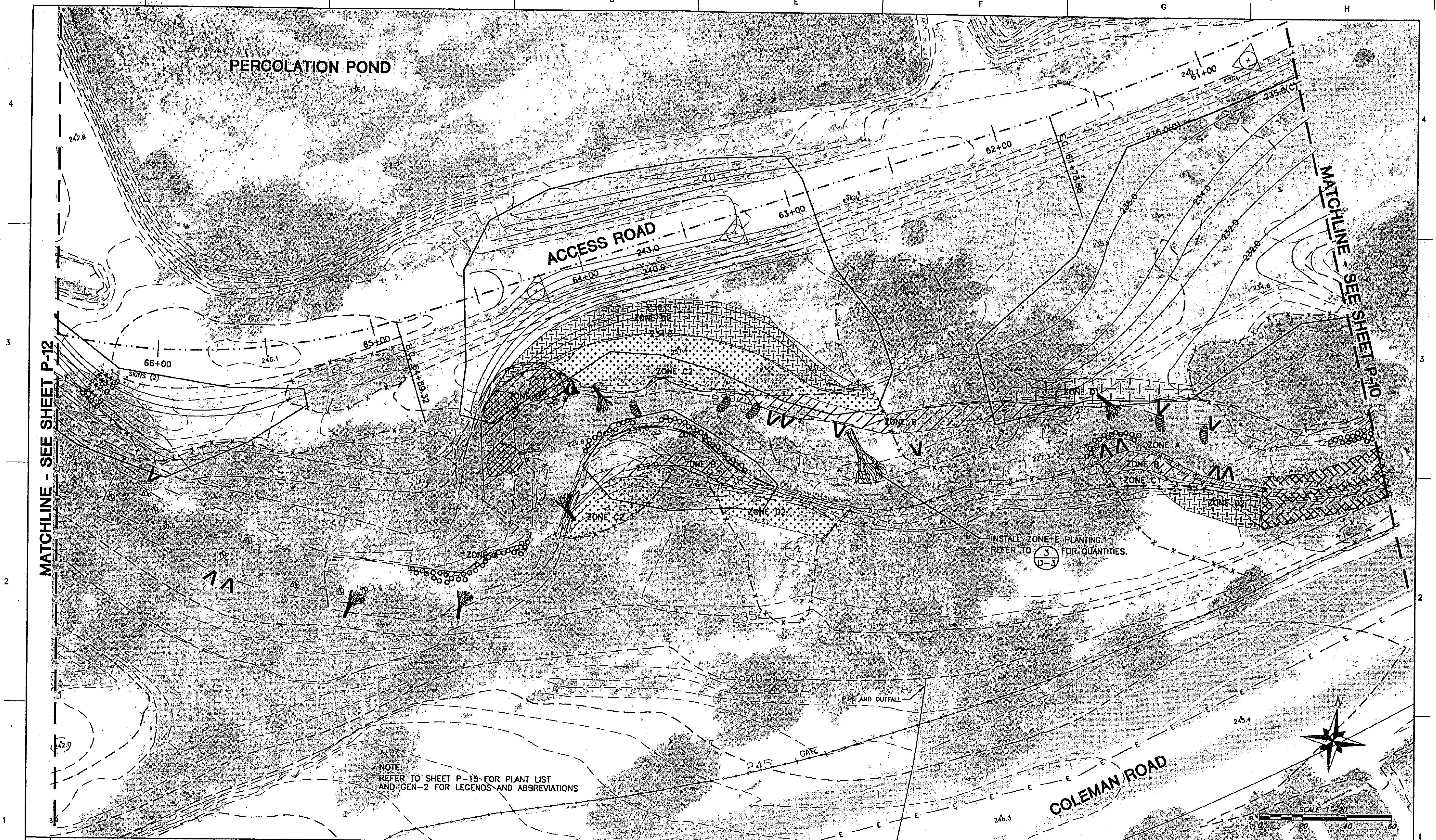
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-10
32 OF 47



INSTALL ZONE E PLANTING. REFER TO $\frac{3}{D-3}$ FOR QUANTITIES.

NOTE:
REFER TO SHEET P-15 FOR PLANT LIST AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

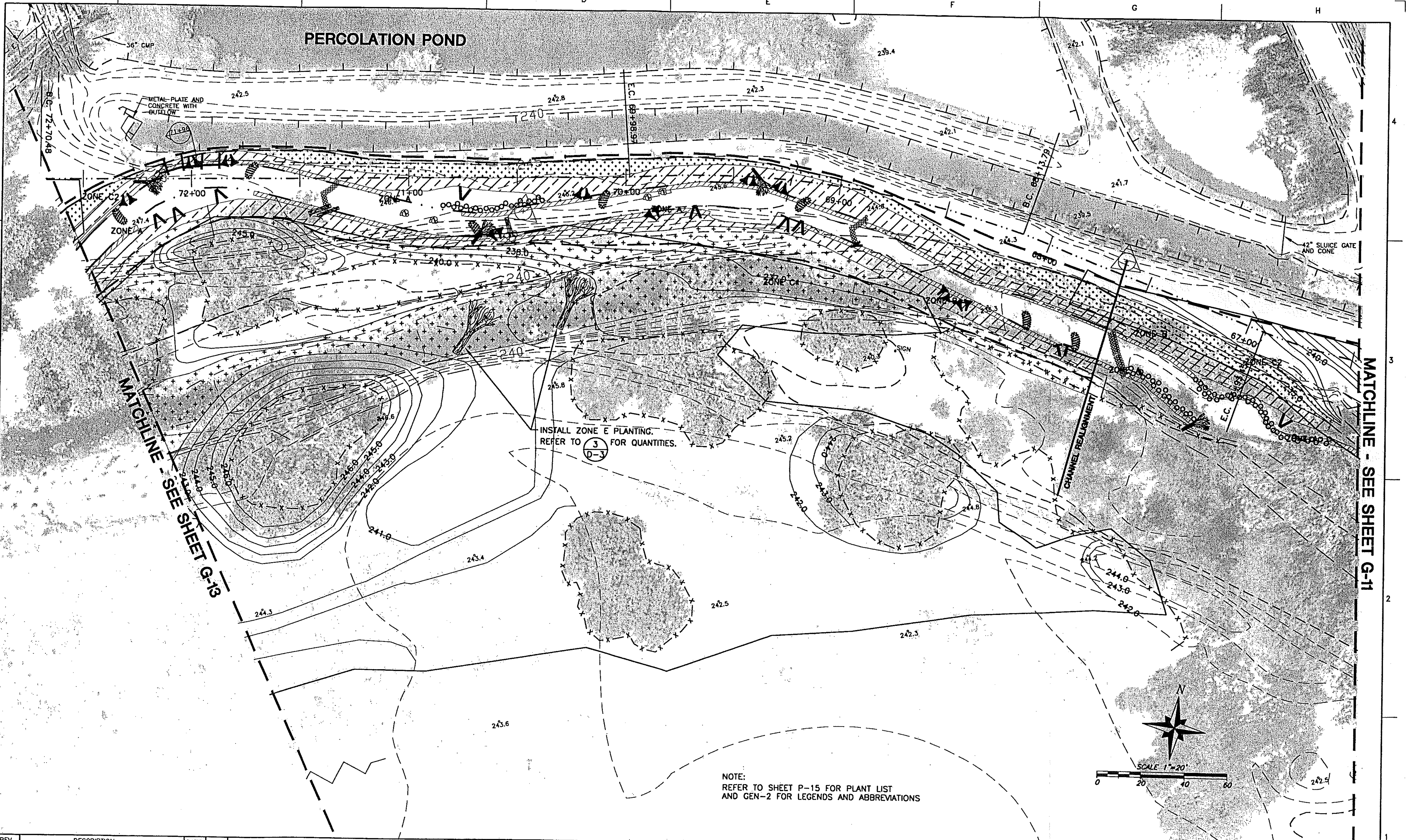
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-11
33 OF 47



INSTALL ZONE E PLANTING.
REFER TO (3/D-3) FOR QUANTITIES.

NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

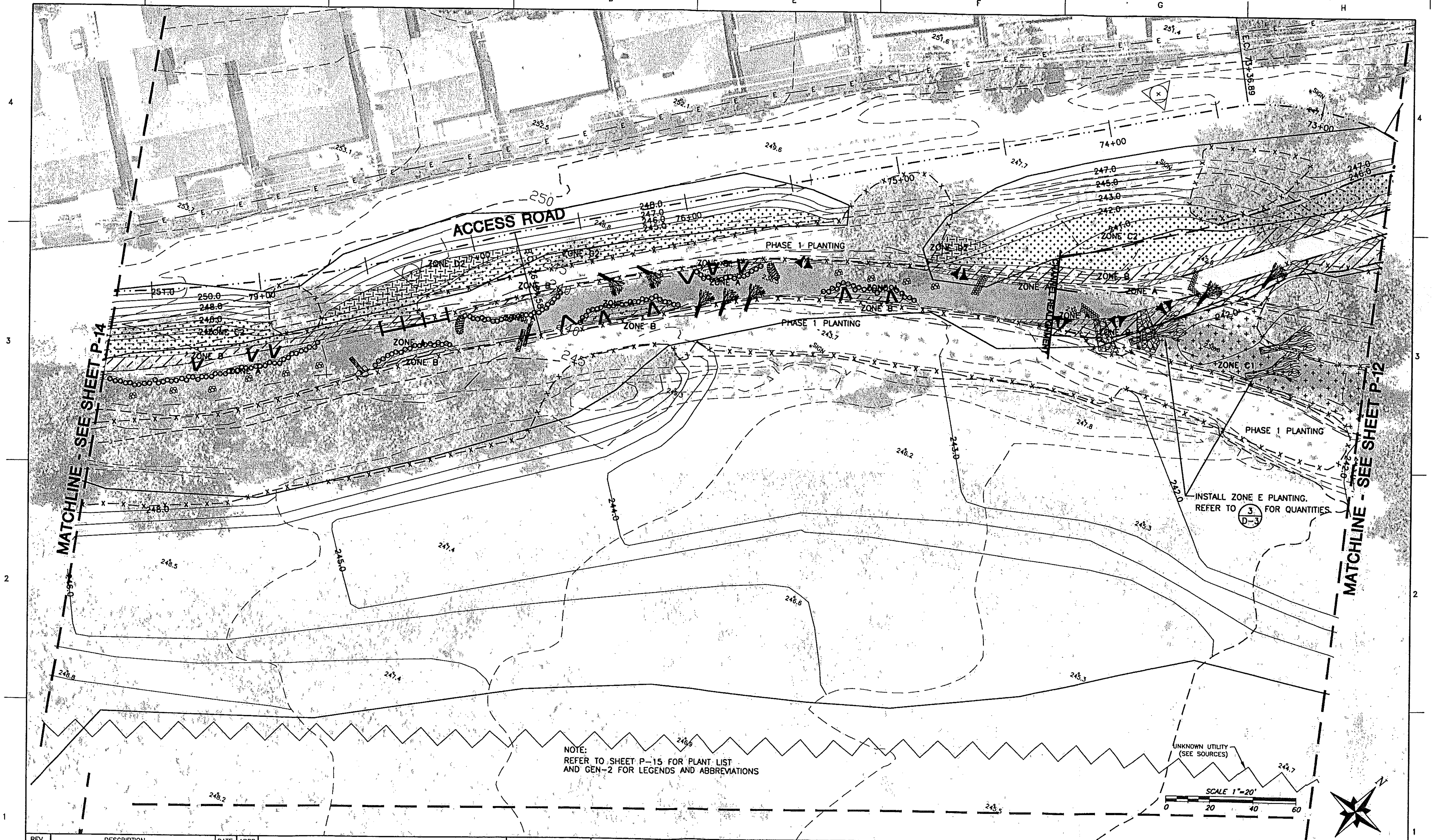
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-12
34 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN JH/KC
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

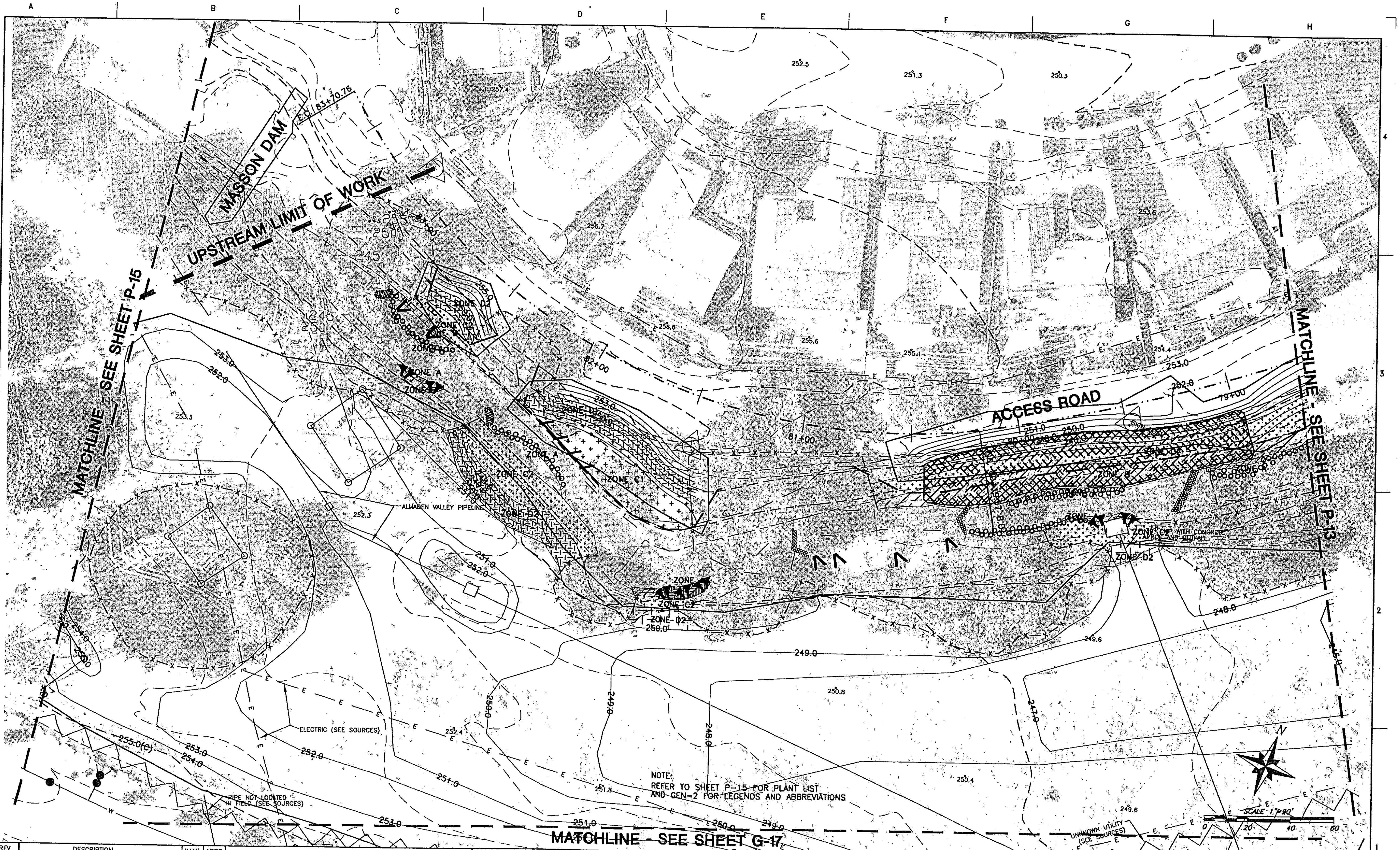
GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
P-13
35 OF 47



NOTE:
REFER TO SHEET P-15 FOR PLANT LIST
AND GEN-2 FOR LEGENDS AND ABBREVIATIONS

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET P-14

36 OF 47

PLANTING PLAN

PLAN VIEW SYMBOL	PLANTING ZONE	DETAIL REFERENCE	SPECIES NAME		PLANTING PROGRAM				
					ZONE PLANT SPACING	CONTAINER PLANTS		CUTTINGS/ACORNS	
			BOTANICAL	COMMON		SIZE	QUANTITY	TYPE	QUANTITY
▨	A (WATERS EDGE)	1/D-8 5/D-8	ALNUS RHOMBIFOLIA	WHITE ALDER	2	DEEPOTS	1332		0
			BACCHARIS SALICIFOLIA	MULE FAT	2	TREEPOTS	339		0
			PLATANUS RACEMOSA	WESTERN SYCAMORE	2	TREEPOTS	1332		0
			POPULUS FREMONTII	FREMONT COTTONWOOD	2		0	TYPE 1	677
			SALIX EXIGUA	SANDBAR WILLOW	2		0	TYPE 1	677
			SALIX LAEVIGATA	RED WILLOW	2		0	TYPE 1	1684
			SALIX LASIOLEPIS	ARROYO WILLOW	2		0	TYPE 1	677
▧	B (LOWER SLOPE--EXISTING)	3/D-8 4/D-8 6/D-8 1/D-9	ALNUS RHOMBIFOLIA	WHITE ALDER	6	DEEPOTS	107		0
			BACCHARIS SALICIFOLIA	MULE FAT	6	TREEPOTS	210		0
			PLATANUS RACEMOSA	WESTERN SYCAMORE	6	TREEPOTS	210		0
			POPULUS FREMONTII	FREMONT COTTONWOOD	6	TREEPOTS	46	TYPE 2	68
			SALIX EXIGUA	SANDBAR WILLOW	6	TREEPOTS	158	TYPE 2	162
			SALIX LAEVIGATA	RED WILLOW	6	TREEPOTS	308	TYPE 2	314
			SALIX LASIOLEPIS	ARROYO WILLOW	6	TREEPOTS	258	TYPE 2	262
+	C1 (UPPER SLOPE OR LOWER BENCH)	3/D-8 4/D-8 6/D-8 1/D-9	ACER NEGUNDO	BOX ELDER	6	DEEPOTS	237		0
			AESCULUS CALIFORNICA	CALIFORNIA BUCKEYE	6	TREEPOTS	237		0
			BACCHARIS SALICIFOLIA	MULE FAT	6	TREEPOTS	122		0
			PLATANUS RACEMOSA	WESTERN SYCAMORE	6	TREEPOTS	237		0
			POPULUS FREMONTII	FREMONT COTTONWOOD	6	TREEPOTS	122	TYPE 2	154
			QUERCUS AGRIFOLIA	COAST LIVE OAK	6		0	ACORN	154
			QUERCUS LOBATA	VALLEY OAK	6	SUPERCELLS	470		0
			ROSA CALIFORNICA	CALIFORNIA ROSE	6	SUPERCELLS	122		0
			SALIX LASIOLEPIS	ARROYO WILLOW	6	TREEPOTS	170	TYPE 2	243
			SAMBUCUS MEXICANA	ELDERBERRY	6	DEEPOTS	122		0
			UMBELLULARIA CALIFORNICA	CALIFORNIA BAY	6		122		0
⁙	C2 (UPPER SLOPE OR LOWER BENCH--LAWHC)	3/D-8 4/D-8 6/D-8 1/D-9 1/D-9	ACER NEGUNDO	BOX ELDER	6	DEEPOTS	234		0
			AESCULUS CALIFORNICA	CALIFORNIA BUCKEYE	6	TREEPOTS	234		0
			ARTEMISIA CALIFORNICA	CALIFORNIA SAGEBRUSH	6	DEEPOTS	0		0
			BACCHARIS SALICIFOLIA	MULE FAT	6	TREEPOTS	119		0
			PLATANUS RACEMOSA	WESTERN SYCAMORE	6	TREEPOTS	575		0
			POPULUS FREMONTII	FREMONT COTTONWOOD	6	TREEPOTS	0	TYPE 2	213
			QUERCUS LOBATA	VALLEY OAK	6	SUPERCELLS	348		0
			ROSA CALIFORNICA	CALIFORNIA ROSE	6	SUPERCELLS	76		0
			SALIX LASIOLEPIS	ARROYO WILLOW	6	TREEPOTS	177	TYPE 2	162
			SAMBUCUS MEXICANA	ELDERBERRY	6	DEEPOTS	52		0
			UMBELLULARIA CALIFORNICA	CALIFORNIA BAY	6		119		0
▤	D1 (UPPER BENCH)	5/D-8 2/D-9	ACER NEGUNDO	BOX ELDER	12	DEEPOTS	8		0
			AESCULUS CALIFORNICA	CALIFORNIA BUCKEYE	12	TREEPOTS	11		0
			ARTEMISIA CALIFORNICA	CALIFORNIA SAGEBRUSH	12	DEEPOTS	8		0
			BACCHARIS PILULARIS	COYOTE BRUSH	12		7		0
			QUERCUS AGRIFOLIA	COAST LIVE OAK	12		0	ACORN	19
			QUERCUS DOUGLASII	BLUE OAK	12	SUPERCELLS	11		0
			QUERCUS LOBATA	VALLEY OAK	12	SUPERCELLS	19		0
			ROSA CALIFORNICA	CALIFORNIA ROSE	12	SUPERCELLS	8		0
			SAMBUCUS MEXICANA	ELDERBERRY	12	DEEPOTS	11		0
			SYMPHORICARPUS ALBUS	SNOWBERRY	12		7		0
			UMBELLULARIA CALIFORNICA	CALIFORNIA BAY	12		11		0
▦	D2 (UPPER BENCH--LAWHC)	5/D-8 2/D-9	AESCULUS CALIFORNICA	CALIFORNIA BUCKEYE	12	TREEPOTS	20		0
			ARTEMISIA CALIFORNICA	CALIFORNIA SAGEBRUSH	12	DEEPOTS	10		0
			BACCHARIS PILULARIS	COYOTE BRUSH	12		10		0
			QUERCUS AGRIFOLIA	COAST LIVE OAK	12		0	ACORN	33
			QUERCUS DOUGLASII	BLUE OAK	12	SUPERCELLS	31		0
			QUERCUS LOBATA	VALLEY OAK	12	SUPERCELLS	10		0
			ROSA CALIFORNICA	CALIFORNIA ROSE	12	SUPERCELLS	10		0
			SAMBUCUS MEXICANA	ELDERBERRY	12	DEEPOTS	15		0
			UMBELLULARIA CALIFORNICA	CALIFORNIA BAY	12		10		0
▩	E (BAR SURFACE)	2/D-8 5/D-8	ALNUS RHOMBIFOLIA	WHITE ALDER		DEEPOTS	342		0
			BACCHARIS SALICIFOLIA	MULE FAT		TREEPOTS	342		0
			PLATANUS RACEMOSA	WESTERN SYCAMORE		TREEPOTS	900		0
			POPULUS FREMONTII	FREMONT COTTONWOOD		TREEPOTS	51	TYPE 2	80
			SALIX EXIGUA	SANDBAR WILLOW		TREEPOTS	51	TYPE 2	80
			SALIX LAEVIGATA	RED WILLOW		TREEPOTS	165	TYPE 2	205
			SALIX LASIOLEPIS	ARROYO WILLOW		TREEPOTS	51	TYPE 2	80
						Total	10314		5944

NOTE: SEE 4/D-9 FOR PLANTING ZONES CROSS-SECTION

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT
STAMP

CONSULTANT
STAMP

DATE 07/17/00
DESIGN AR/JB
DRAWN BH/CJ/BK
CHECKED EW/JZ

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

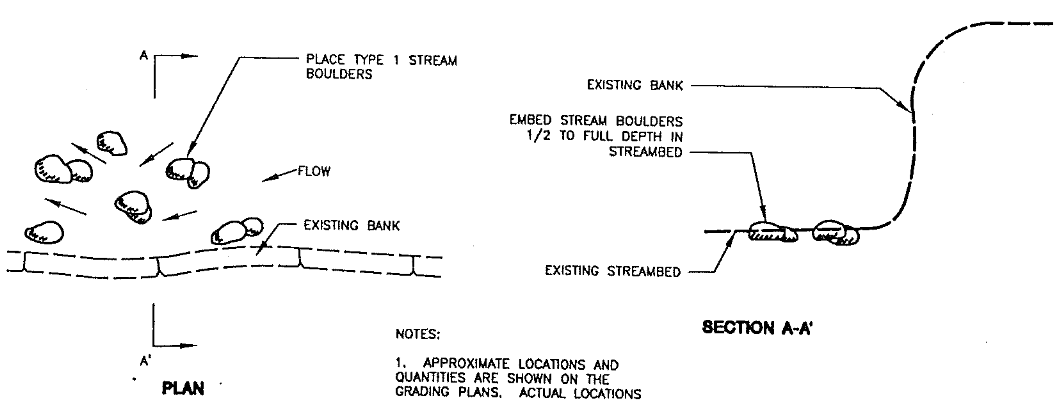
GUADALUPE CREEK
RESTORATION PROJECT

PLANTING PLAN

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
P-15
37 OF 47

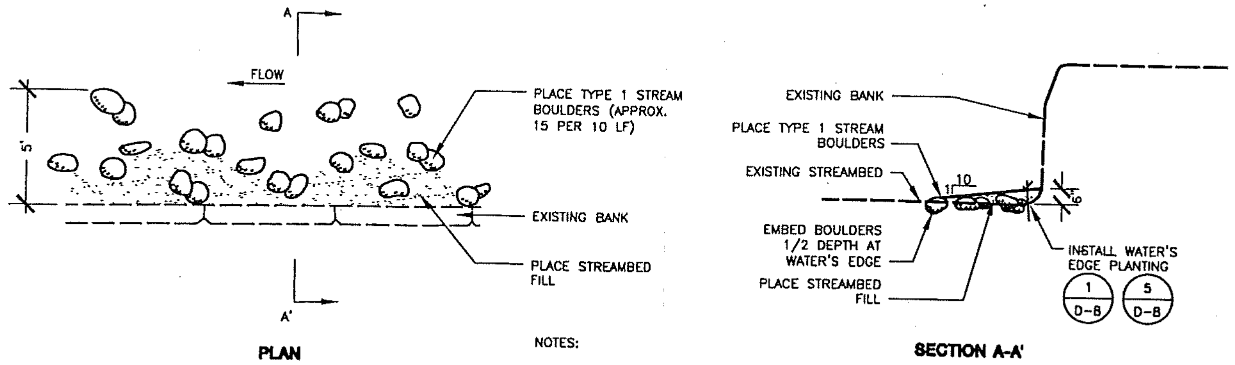


A
PLACE TYPE 1 STREAM BOULDERS
FLOW
EXISTING BANK
A'
PLAN
EXISTING BANK
EMBED STREAM BOULDERS 1/2 TO FULL DEPTH IN STREAMBED
EXISTING STREAMBED
SECTION A-A'

NOTES:

1. APPROXIMATE LOCATIONS AND QUANTITIES ARE SHOWN ON THE GRADING PLANS. ACTUAL LOCATIONS AND PLACEMENT WILL BE DIRECTED BY ENGINEER.

1 / D-1 **STREAM BOULDER PLACEMENT**
Not To Scale



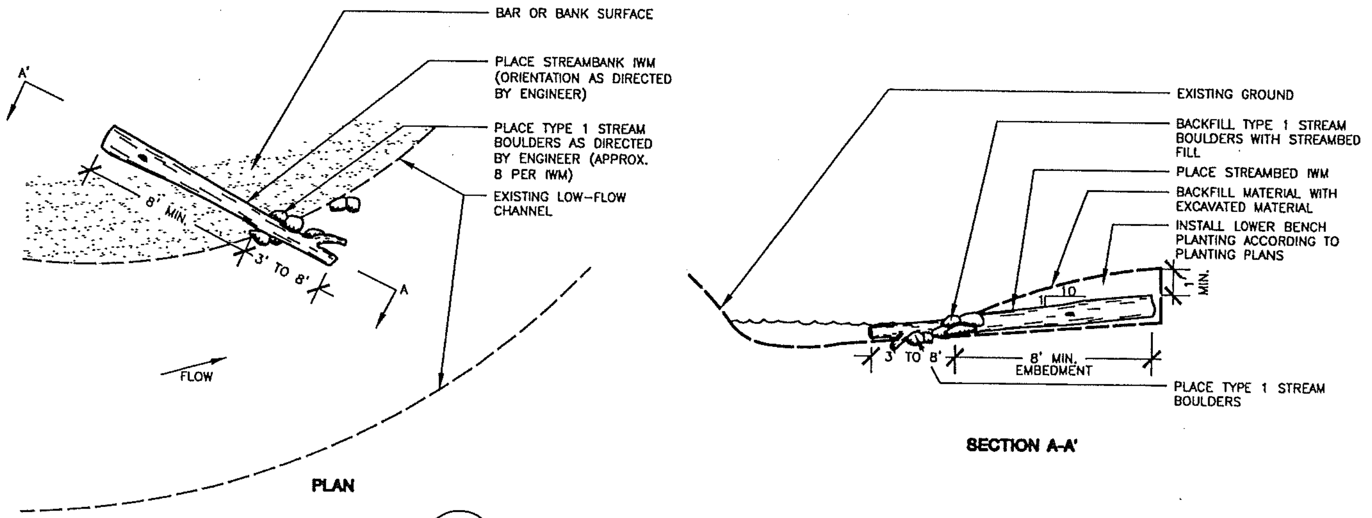
A
FLOW
5'
PLACE TYPE 1 STREAM BOULDERS (APPROX. 15 PER 10 LF)
EXISTING BANK
PLACE STREAMBED FILL
A'
PLAN
EXISTING BANK
PLACE TYPE 1 STREAM BOULDERS
EXISTING STREAMBED
10
1
EMBED BOULDERS 1/2 DEPTH AT WATER'S EDGE
PLACE STREAMBED FILL
INSTALL WATER'S EDGE PLANTING
1 / D-8
5 / D-8
SECTION A-A'

NOTES:

1. STREAM BOULDERS WILL BE PLACED FIRST TO FORM IRREGULAR EDGE. STREAMBED FILL WILL BE PLACED OVER EXISTING STREAMBED AND PLACED STREAM BOULDERS.

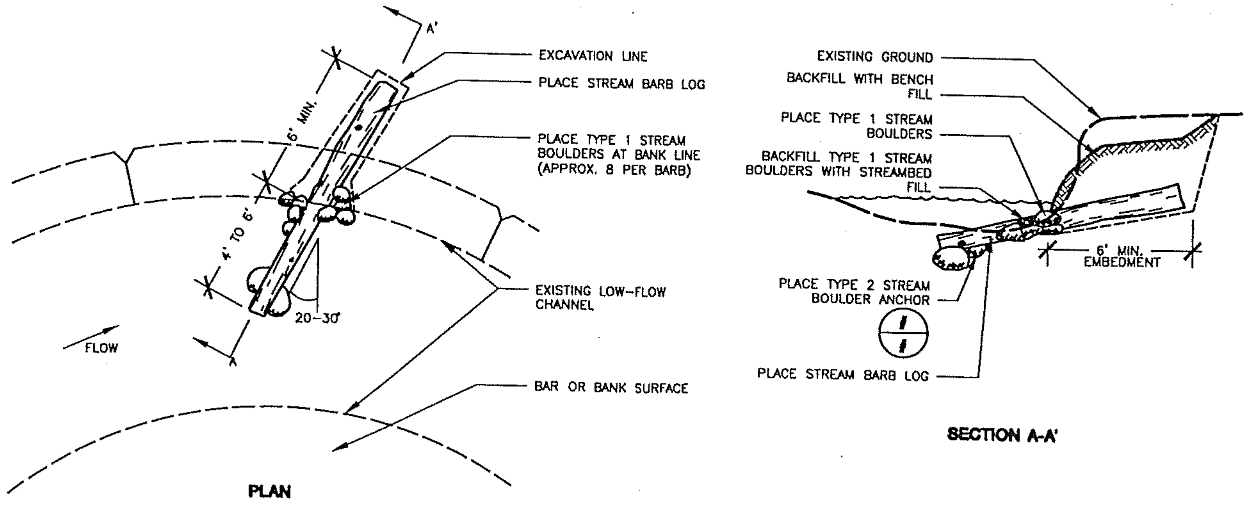
2. INSTALL PLANTS AT TOE OF EXISTING BANK.

2 / D-1 **WATER'S EDGE TREATMENT**
Not To Scale



BAR OR BANK SURFACE
PLACE STREAMBANK IWM (ORIENTATION AS DIRECTED BY ENGINEER)
PLACE TYPE 1 STREAM BOULDERS AS DIRECTED BY ENGINEER (APPROX. 8 PER IWM)
EXISTING LOW-FLOW CHANNEL
A'
8' MIN.
3' TO 8'
A
FLOW
PLAN
EXISTING GROUND
BACKFILL TYPE 1 STREAM BOULDERS WITH STREAMBED FILL
PLACE STREAMBED IWM
BACKFILL MATERIAL WITH EXCAVATED MATERIAL
INSTALL LOWER BENCH PLANTING ACCORDING TO PLANTING PLANS
10
1
1' MIN.
3' TO 8'
8' MIN. EMBEDMENT
PLACE TYPE 1 STREAM BOULDERS
SECTION A-A'

3 / D-1 **STREAMBANK INSTREAM WOODY MATERIAL (IWM)**
Not To Scale



A'
6' MIN.
EXCAVATION LINE
PLACE STREAM BARB LOG
PLACE TYPE 1 STREAM BOULDERS AT BANK LINE (APPROX. 8 PER BARB)
4' TO 6'
20-30°
EXISTING LOW-FLOW CHANNEL
FLOW
BAR OR BANK SURFACE
PLAN
EXISTING GROUND
BACKFILL WITH BENCH FILL
PLACE TYPE 1 STREAM BOULDERS
BACKFILL TYPE 1 STREAM BOULDERS WITH STREAMBED FILL
6' MIN. EMBEDMENT
PLACE TYPE 2 STREAM BOULDER ANCHOR
PLACE STREAM BARB LOG
SECTION A-A'

4 / D-1 **STREAM BARB**
Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

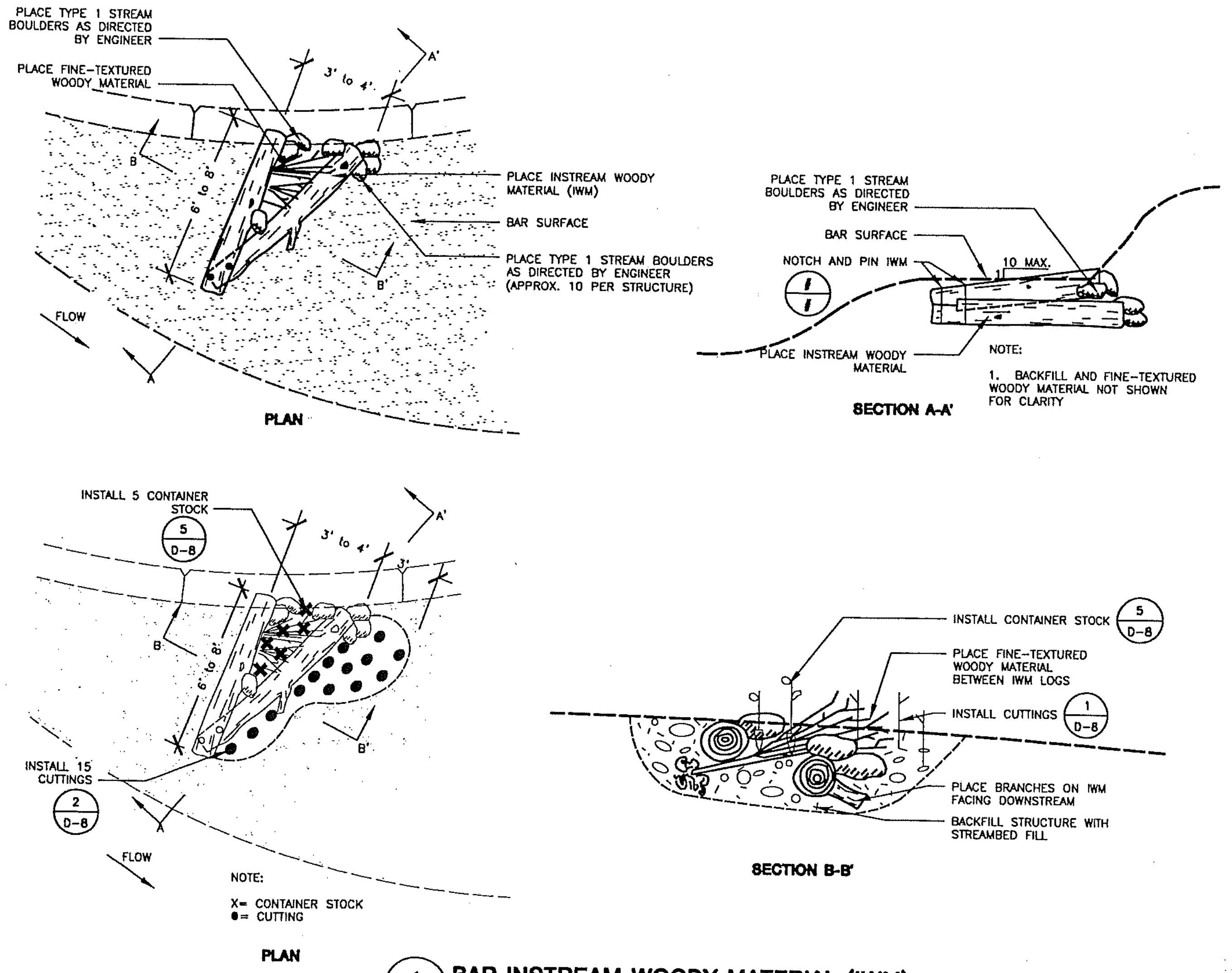
DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B.
CHECKED E.W./J.Z.

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT
INSTREAM STRUCTURES DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN
SHEET D-1
38 OF 47


PLACE TYPE 1 STREAM BOULDERS AS DIRECTED BY ENGINEER
PLACE FINE-TEXTURED WOODY MATERIAL
3' to 4'
A'
B
6' to 8'
PLACE INSTREAM WOODY MATERIAL (IWM)
BAR SURFACE
PLACE TYPE 1 STREAM BOULDERS AS DIRECTED BY ENGINEER (APPROX. 10 PER STRUCTURE)
B'
FLOW
PLACE TYPE 1 STREAM BOULDERS AS DIRECTED BY ENGINEER
BAR SURFACE
NOTCH AND PIN IWM
10 MAX.
PLACE INSTREAM WOODY MATERIAL
INSTALL 5 CONTAINER STOCK
5
D-8
3' to 4'
3'
A'
B
6' to 8'
B'
INSTALL 15 CUTTINGS
2
D-8
FLOW
INSTALL CONTAINER STOCK
5
D-8
PLACE FINE-TEXTURED WOODY MATERIAL BETWEEN IWM LOGS
INSTALL CUTTINGS
1
D-8
PLACE BRANCHES ON IWM FACING DOWNSTREAM
BACKFILL STRUCTURE WITH STREAMBED FILL

PLAN

SECTION A-A'

NOTE:

1. BACKFILL AND FINE-TEXTURED WOODY MATERIAL NOT SHOWN FOR CLARITY

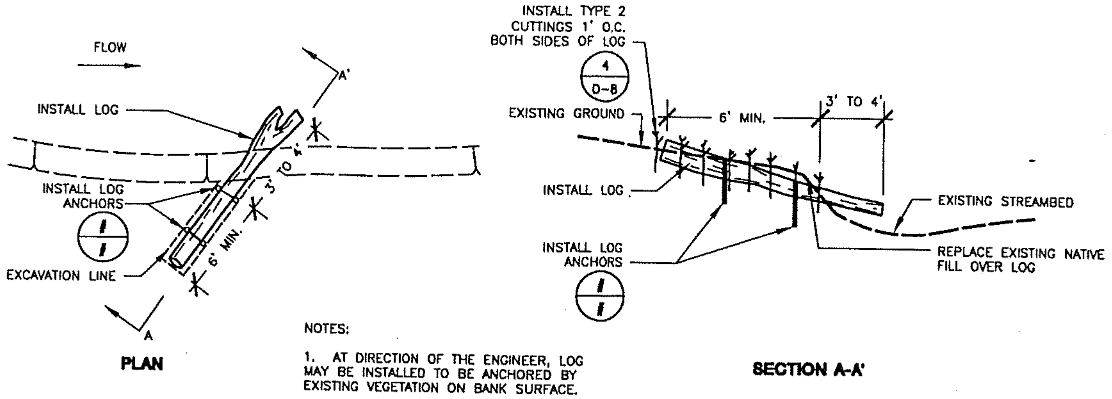
NOTE:

X= CONTAINER STOCK
●= CUTTING

PLAN

SECTION B-B'

1 / D-2 BAR INSTREAM WOODY MATERIAL (IWM)
Not To Scale



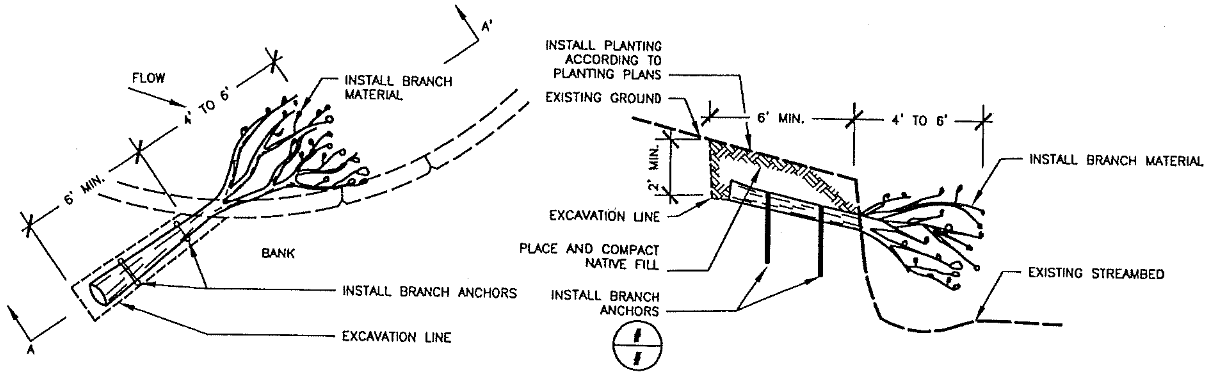
PLAN

NOTES:

1. AT DIRECTION OF THE ENGINEER, LOG MAY BE INSTALLED TO BE ANCHORED BY EXISTING VEGETATION ON BANK SURFACE.

SECTION A-A'

2 / D-2 OFF-BANK LOG COVER
Not To Scale



PLAN

SECTION A-A'

3 / D-2 OFF-BANK BRANCH COVER
Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B.
CHECKED E.W./J.Z.

Santa Clara Valley Water District

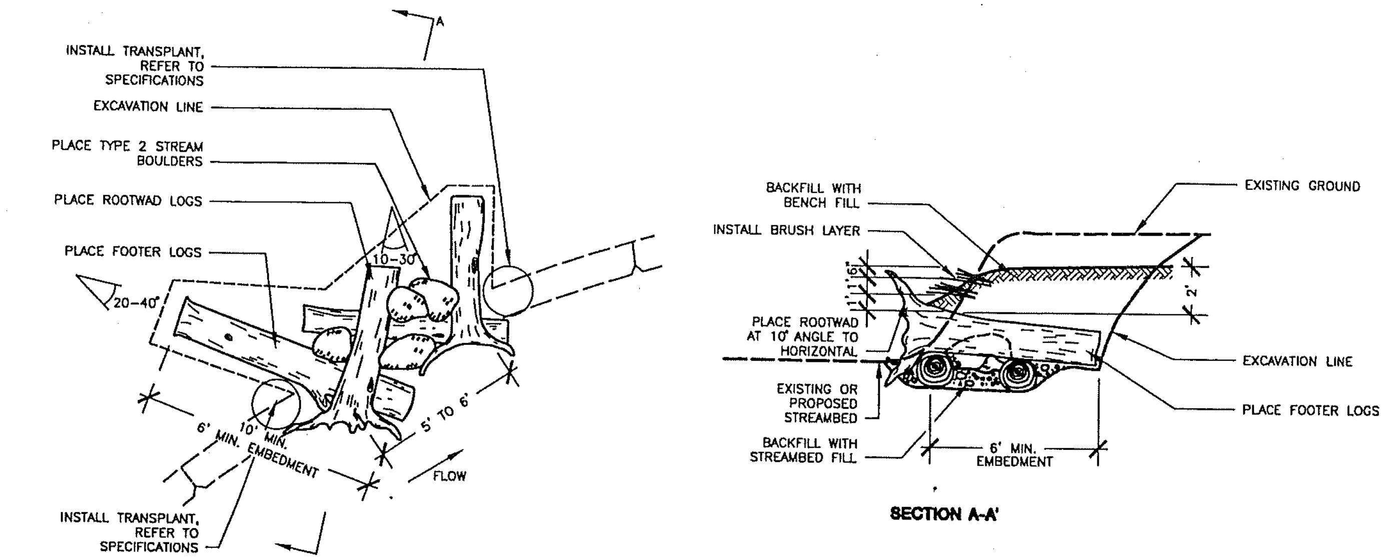
ACCEPTED BY DISTRICT

DATE

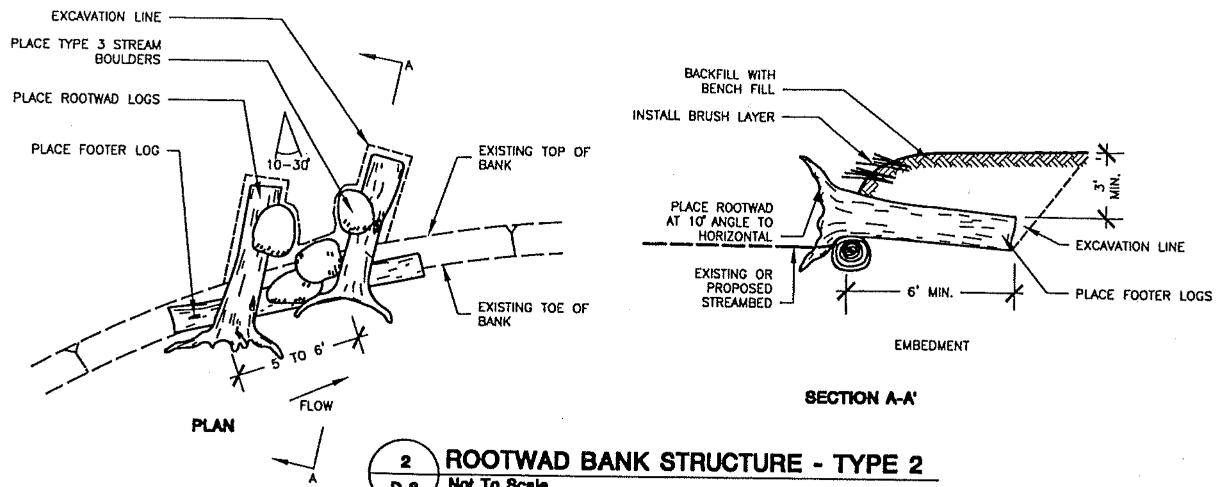
GUADALUPE CREEK
RESTORATION PROJECT
INSTREAM STRUCTURES DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

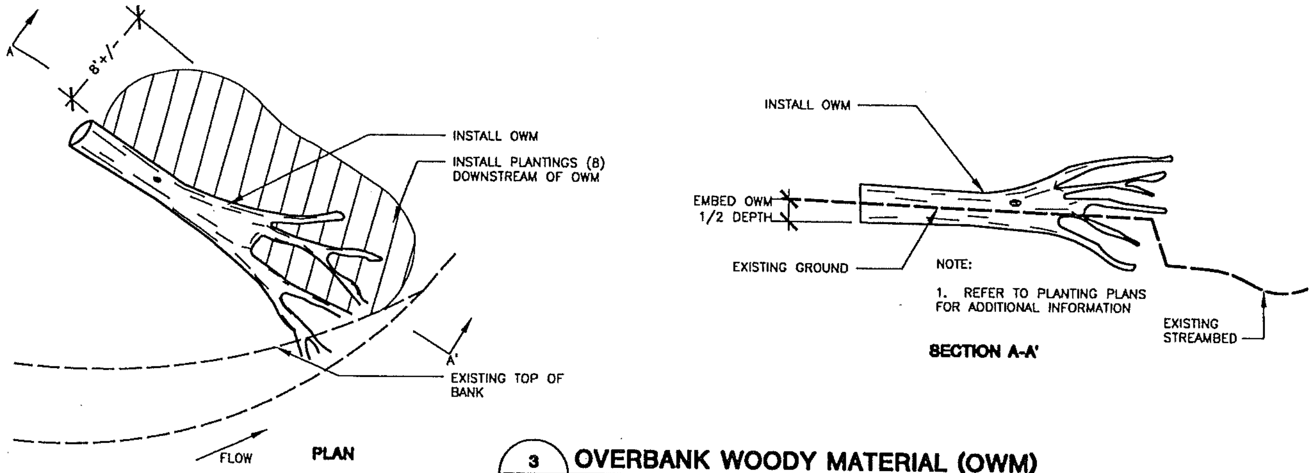
SCALE
AS SHOWN
SHEET
D-2
39 OF 47



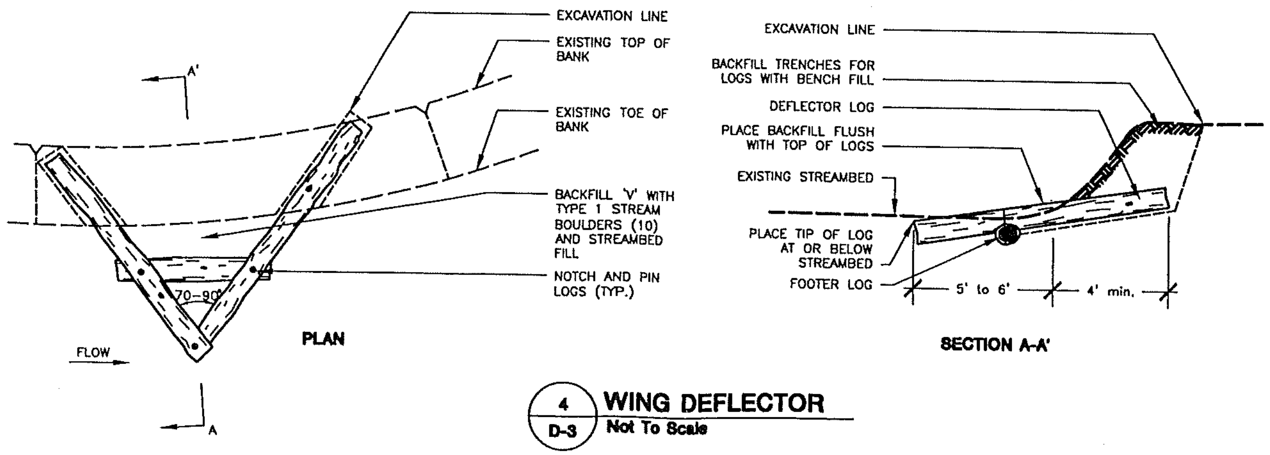
① D-3 ROOTWAD BANK STRUCTURE - TYPE 1
Not To Scale



② D-3 ROOTWAD BANK STRUCTURE - TYPE 2
Not To Scale



③ D-3 OVERBANK WOODY MATERIAL (OWM)
Not To Scale


A'
70-90°
FLOW
A
PLAN
EXCAVATION LINE
EXISTING TOP OF BANK
EXISTING TOE OF BANK
BACKFILL 'V' WITH TYPE 1 STREAM BOULDERS (10) AND STREAMBED FILL
NOTCH AND PIN LOGS (TYP.)
EXCAVATION LINE
BACKFILL TRENCHES FOR LOGS WITH BENCH FILL
DEFLECTOR LOG
PLACE BACKFILL FLUSH WITH TOP OF LOGS
EXISTING STREAMBED
PLACE TIP OF LOG AT OR BELOW STREAMBED
FOOTER LOG
5' to 6'
4' min.
SECTION A-A'

④ D-3 WING DEFLECTOR
Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

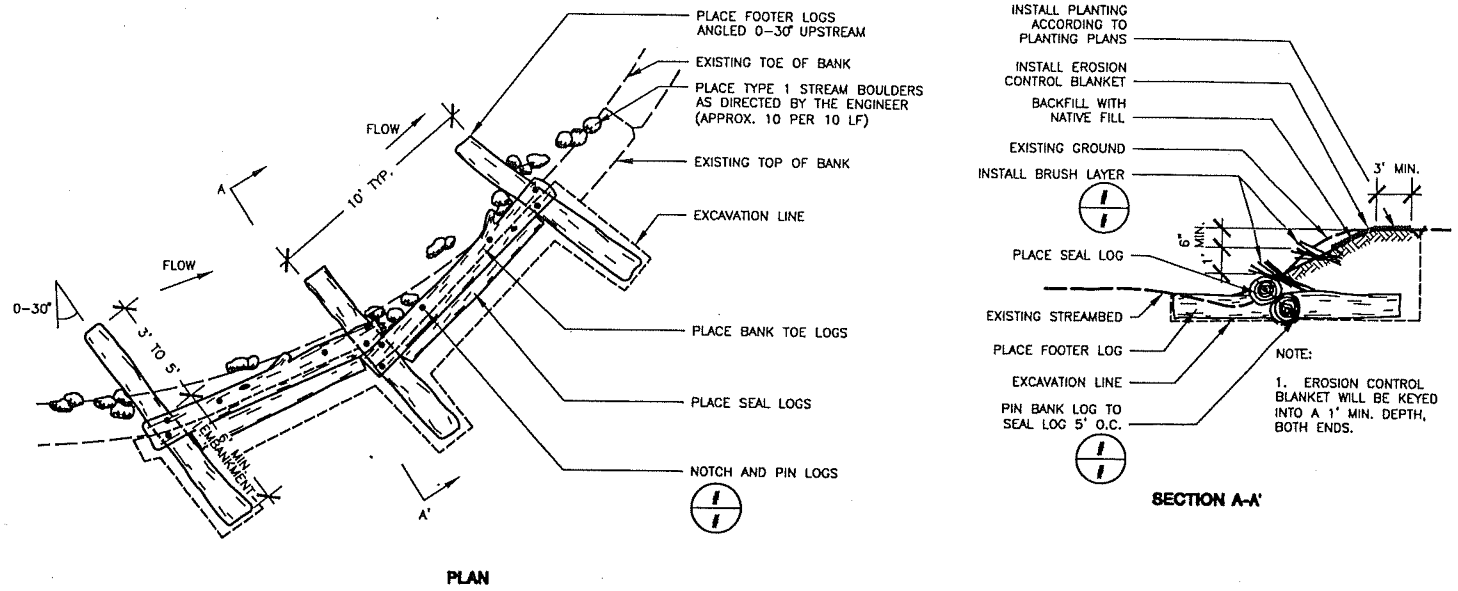
DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B.
CHECKED E.W./J.Z.

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT
INSTREAM STRUCTURES DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN
SHEET
D-3
40 OF 47



PLAN

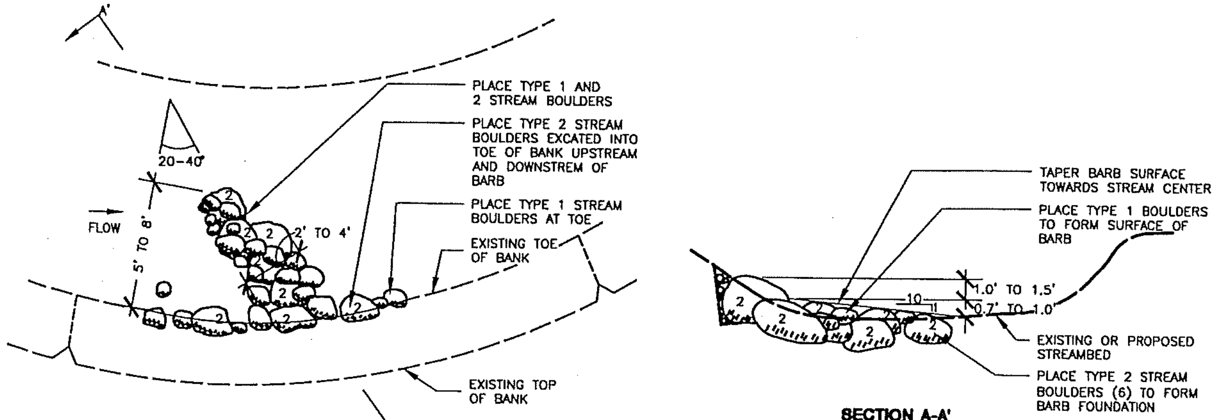
SECTION A-A'

NOTE:

1. EROSION CONTROL BLANKET WILL BE KEYED INTO A 1' MIN. DEPTH, BOTH ENDS.

1/D-4 LOG TOE BANK STRUCTURE

Not To Scale



A'
A
FLOW
20–40°
5' TO 8'
2' TO 4'
2
PLACE TYPE 1 AND 2 STREAM BOULDERS
PLACE TYPE 2 STREAM BOULDERS EXCATED INTO TOE OF BANK UPSTREAM AND DOWNSTREM OF BARB
PLACE TYPE 1 STREAM BOULDERS AT TOE
EXISTING TOE OF BANK
EXISTING TOP OF BANK
TAPER BARB SURFACE TOWARDS STREAM CENTER
PLACE TYPE 1 BOULDERS TO FORM SURFACE OF BARB
1.0' TO 1.5'
0.7' TO 1.0'
10
1
EXISTING OR PROPOSED STREAMBED
PLACE TYPE 2 STREAM BOULDERS (6) TO FORM BARB FOUNDATION

PLAN

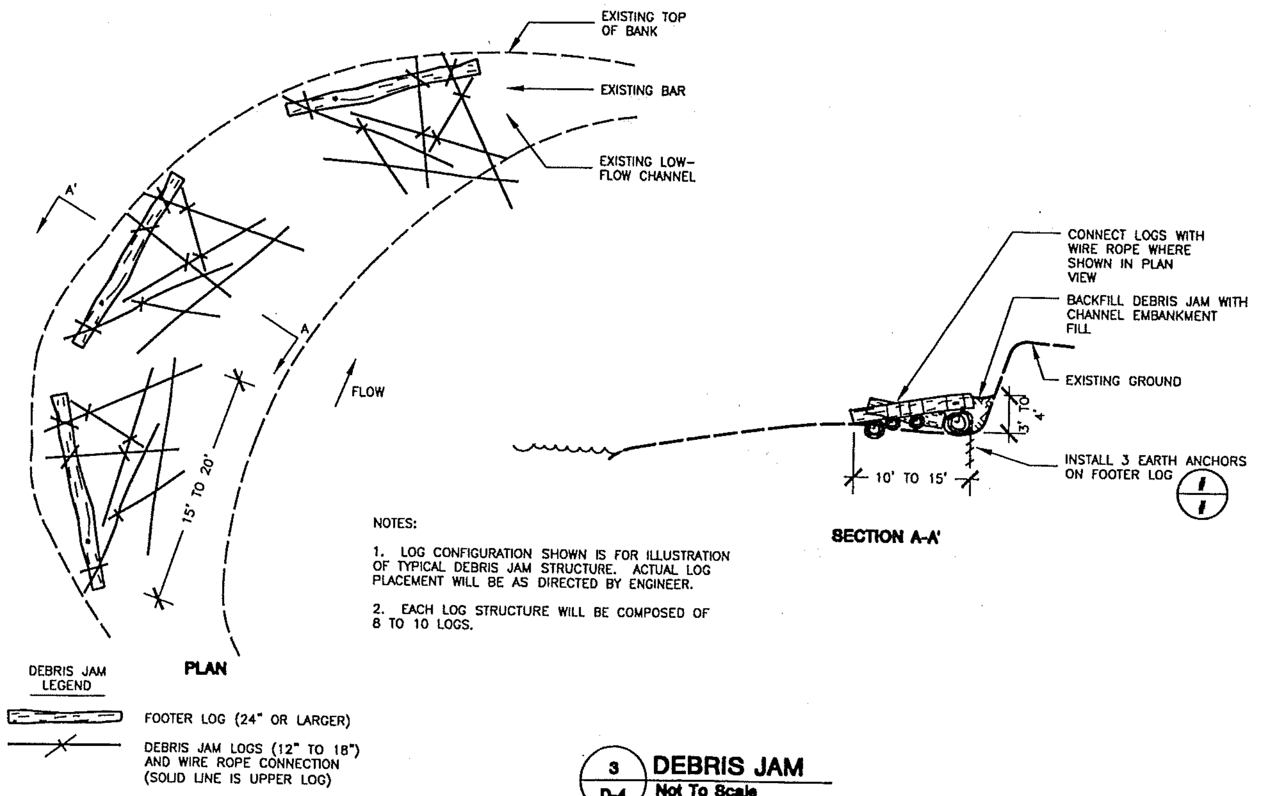
SECTION A-A'

NOTES:

1. STREAM BOULDER PLACEMENT SHOWN IS TO ILLUSTRATE CONSTRUCTION METHOD. PLACEMENT MAY VERY AT EACH BARB, AS DIRECTED BY ENGINEER.

2/D-4 ROCK STREAM BARB

Not To Scale



EXISTING TOP OF BANK
EXISTING BAR
EXISTING LOW-FLOW CHANNEL
A'
A
FLOW
15' TO 20'
CONNECT LOGS WITH WIRE ROPE WHERE SHOWN IN PLAN VIEW
BACKFILL DEBRIS JAM WITH CHANNEL EMBANKMENT FILL
EXISTING GROUND
3' TO 4'
10' TO 15'
INSTALL 3 EARTH ANCHORS ON FOOTER LOG
DEBRIS JAM LEGEND
FOOTER LOG (24" OR LARGER)
DEBRIS JAM LOGS (12" TO 18") AND WIRE ROPE CONNECTION (SOLID LINE IS UPPER LOG)

PLAN

SECTION A-A'

NOTES:

1. LOG CONFIGURATION SHOWN IS FOR ILLUSTRATION OF TYPICAL DEBRIS JAM STRUCTURE. ACTUAL LOG PLACEMENT WILL BE AS DIRECTED BY ENGINEER.

2. EACH LOG STRUCTURE WILL BE COMPOSED OF 8 TO 10 LOGS.

3/D-4 DEBRIS JAM

Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B.
CHECKED E.W./J.Z.

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

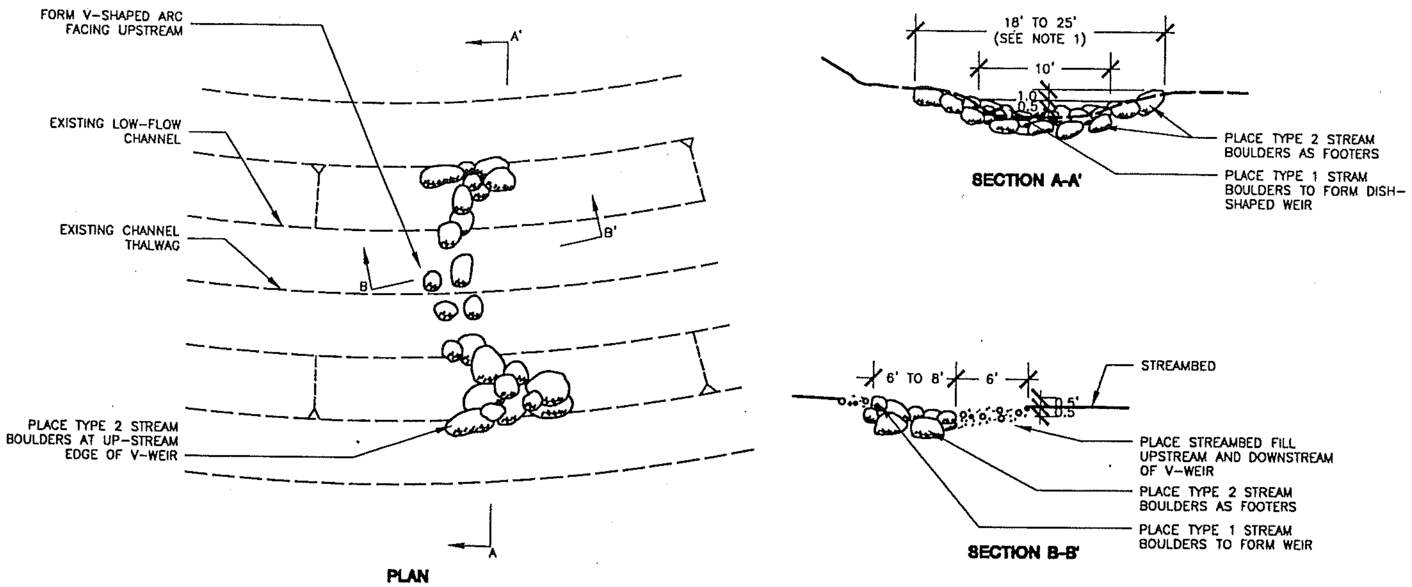
GUADALUPE CREEK
RESTORATION PROJECT

INSTREAM STRUCTURES DETAILS

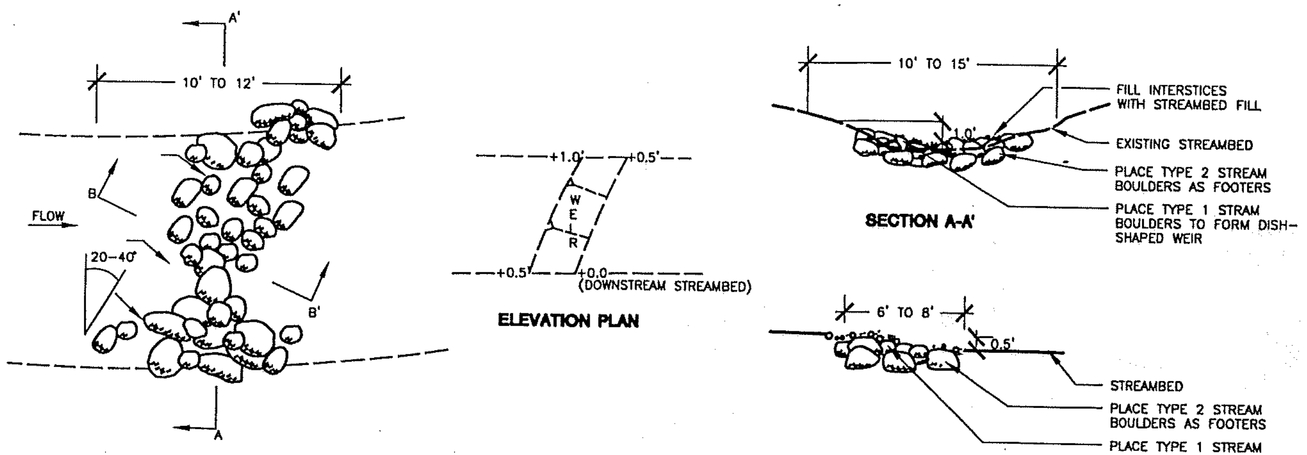
VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

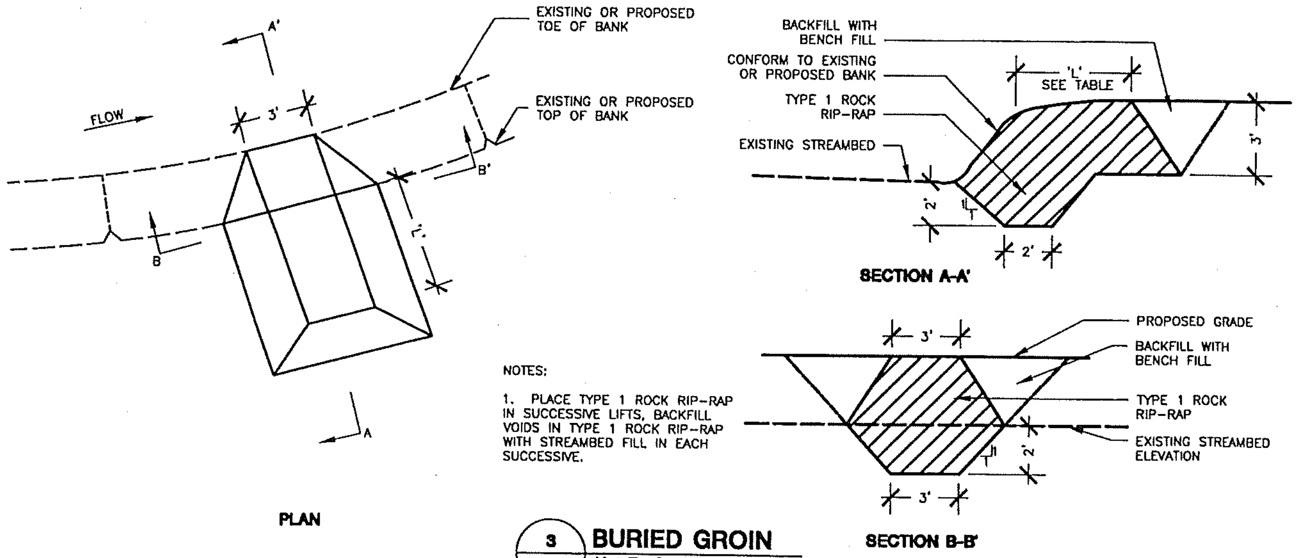
SHEET
D-4
41 OF 47


FORM V-SHAPED ARC FACING UPSTREAM
A'
EXISTING LOW-FLOW CHANNEL
EXISTING CHANNEL THALWAG
B
B'
PLACE TYPE 2 STREAM BOULDERS AT UP-STREAM EDGE OF V-WEIR
A
PLAN
18' TO 25' (SEE NOTE 1)
10'
1.0
0.5
PLACE TYPE 2 STREAM BOULDERS AS FOOTERS
PLACE TYPE 1 STRAM BOULDERS TO FORM DISH-SHAPED WEIR
SECTION A-A'
6' TO 8'
6'
0.5'
0.5
STREAMBED
PLACE STREAMBED FILL UPSTREAM AND DOWNSTREAM OF V-WEIR
PLACE TYPE 2 STREAM BOULDERS AS FOOTERS
PLACE TYPE 1 STREAM BOULDERS TO FORM WEIR
SECTION B-B'

1 / D-5 **V-WEIR**
Not To Scale


A'
10' TO 12'
B
FLOW
20-40°
B'
A
PLAN
+1.0'
+0.5'
W E I R
+0.5'
+0.0 (DOWNSTREAM STREAMBED)
ELEVATION PLAN
10' TO 15'
1.0'
FILL INTERSTICES WITH STREAMBED FILL
EXISTING STREAMBED
PLACE TYPE 2 STREAM BOULDERS AS FOOTERS
PLACE TYPE 1 STRAM BOULDERS TO FORM DISH-SHAPED WEIR
SECTION A-A'
6' TO 8'
0.5'
STREAMBED
PLACE TYPE 2 STREAM BOULDERS AS FOOTERS
PLACE TYPE 1 STREAM BOULDERS TO FORM WEIR SURFACE
SECTION B-B'

2 / D-5 **CROSS WEIR**
Not To Scale



NOTES:

1. PLACE TYPE 1 ROCK RIP-RAP IN SUCCESSIVE LIFTS, BACKFILL VOIDS IN TYPE 1 ROCK RIP-RAP WITH STREAMBED FILL IN EACH SUCCESSIVE.

3 / D-5 **BURIED GROIN**
Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

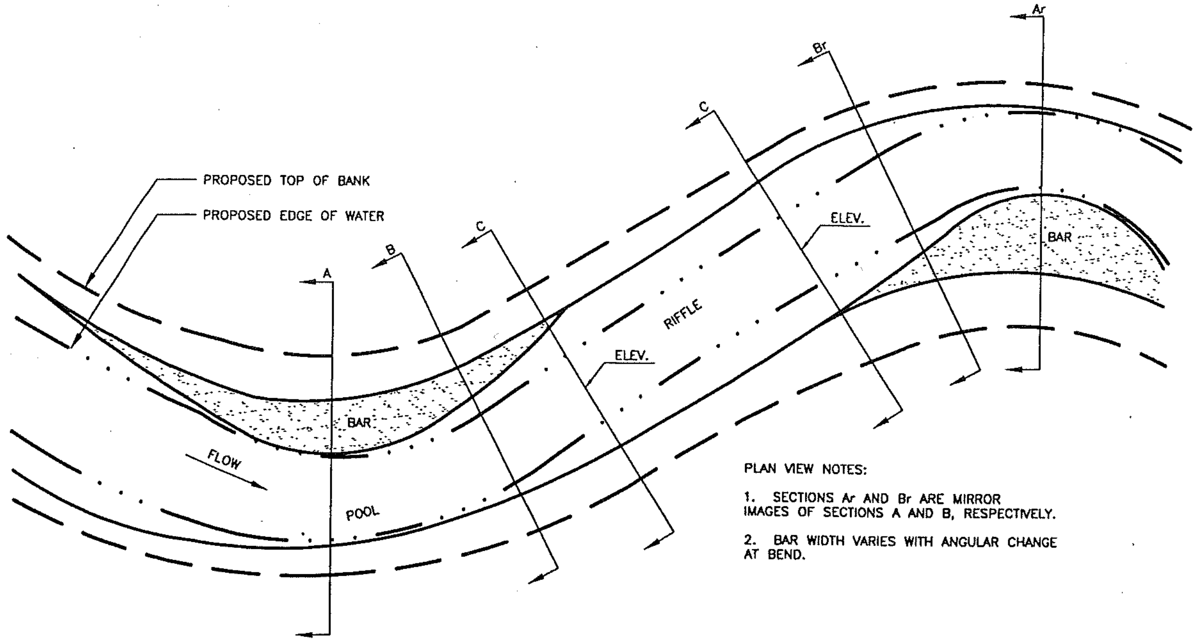
DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B.
CHECKED E.W./J.Z.

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT
INSTREAM STRUCTURES DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

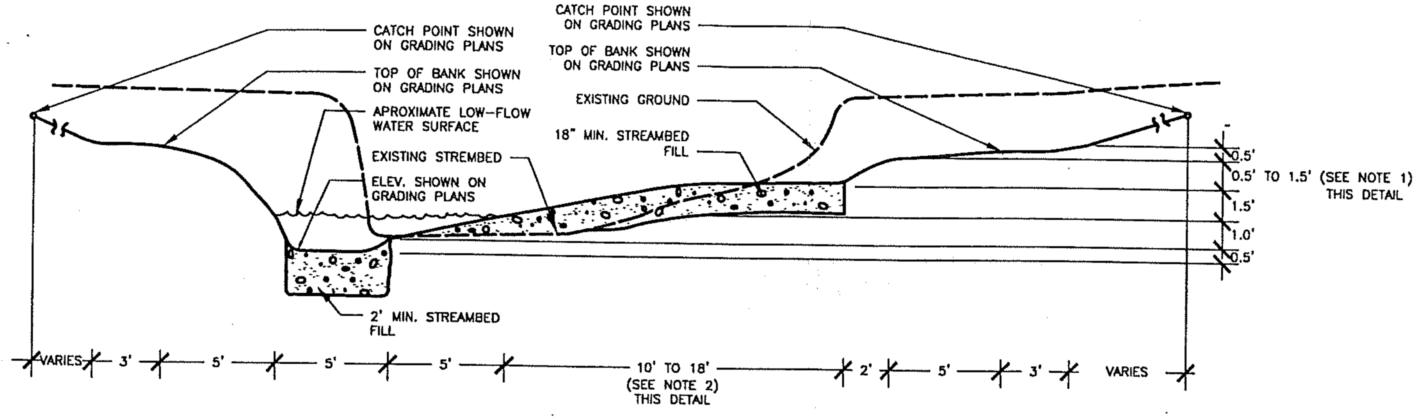
SCALE AS SHOWN
SHEET
D-5
42 OF 47


Ar
Br
C
PROPOSED TOP OF BANK
PROPOSED EDGE OF WATER
B
C
A
ELEV.
BAR
RIFFLE
ELEV.
BAR
FLOW
POOL
PLAN VIEW NOTES:
1. SECTIONS Ar AND Br ARE MIRROR IMAGES OF SECTIONS A AND B, RESPECTIVELY.
2. BAR WIDTH VARIES WITH ANGULAR CHANGE AT BEND.

1
D-6

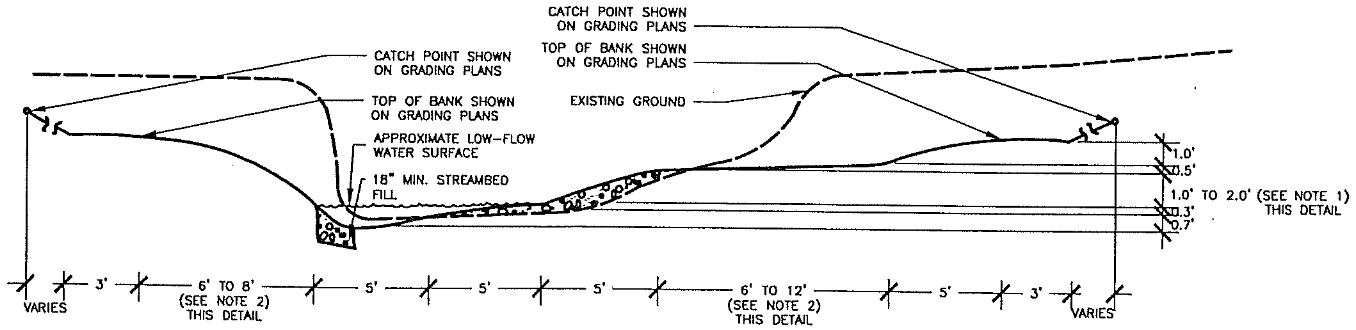
CHANNEL REALIGNMENT - TYPICAL SECTION LOCATIONS

Not To Scale


CATCH POINT SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
APROXIMATE LOW-FLOW WATER SURFACE
EXISTING STREMBED
ELEV. SHOWN ON GRADING PLANS
CATCH POINT SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
EXISTING GROUND
18" MIN. STREAMBED FILL
2' MIN. STREAMBED FILL
0.5'
0.5' TO 1.5' (SEE NOTE 1) THIS DETAIL
1.5'
1.0'
0.5'
VARIES
3'
5'
5'
5'
10' TO 18' (SEE NOTE 2) THIS DETAIL
2'
5'
3'
VARIES

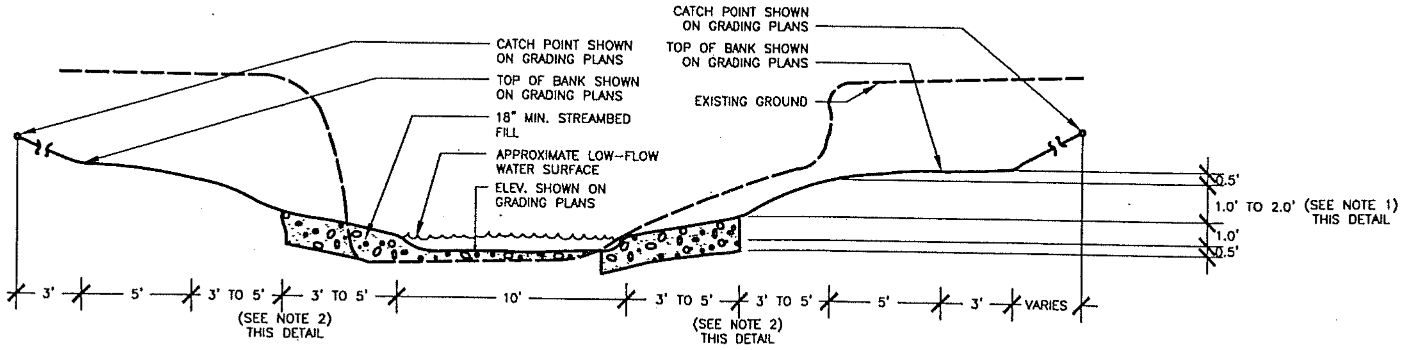
SECTION A (LOOKING UPSTREAM)

Not To Scale


CATCH POINT SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
EXISTING GROUND
CATCH POINT SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
APPROXIMATE LOW-FLOW WATER SURFACE
18" MIN. STREAMBED FILL
1.0'
0.5'
1.0' TO 2.0' (SEE NOTE 1) THIS DETAIL
0.3'
0.7'
VARIES
3'
6' TO 8' (SEE NOTE 2) THIS DETAIL
5'
5'
5'
6' TO 12' (SEE NOTE 2) THIS DETAIL
5'
3'
VARIES

SECTION B (LOOKING UPSTREAM)

Not To Scale


CATCH POINT SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
EXISTING GROUND
CATCH POINT SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
18" MIN. STREAMBED FILL
APPROXIMATE LOW-FLOW WATER SURFACE
ELEV. SHOWN ON GRADING PLANS
0.5'
1.0' TO 2.0' (SEE NOTE 1) THIS DETAIL
1.0'
0.5'
3'
5'
3' TO 5'
3' TO 5'
(SEE NOTE 2) THIS DETAIL
10'
3' TO 5'
3' TO 5'
(SEE NOTE 2) THIS DETAIL
5'
3'
VARIES

SECTION C (LOOKING UPSTREAM)

Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B.
CHECKED E.W./J.Z.

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT

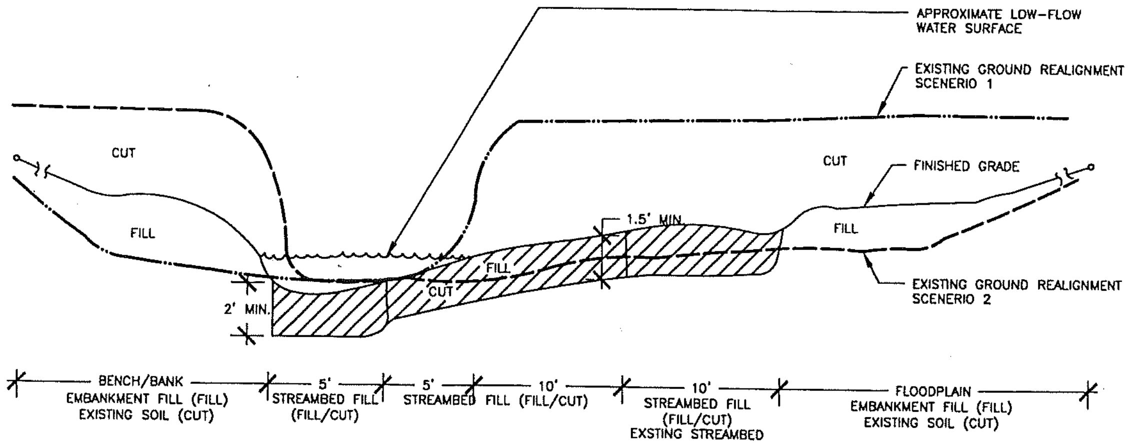
CHANNEL REALIGNMENT DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

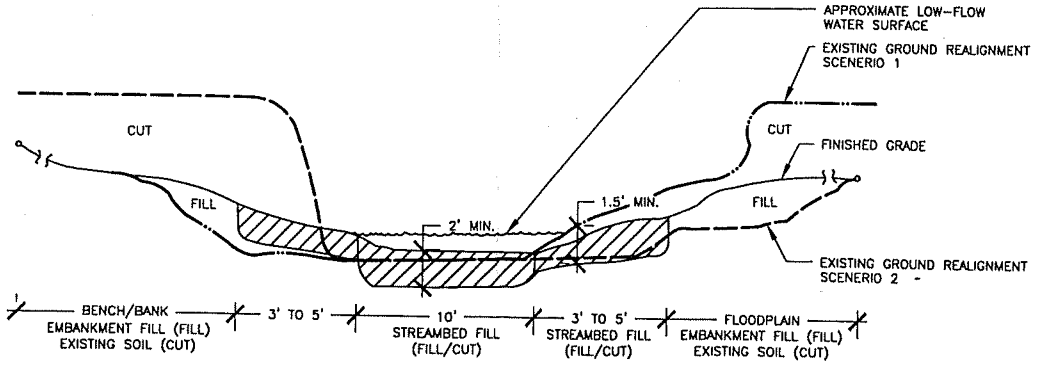
SCALE AS SHOWN

SHEET D-6

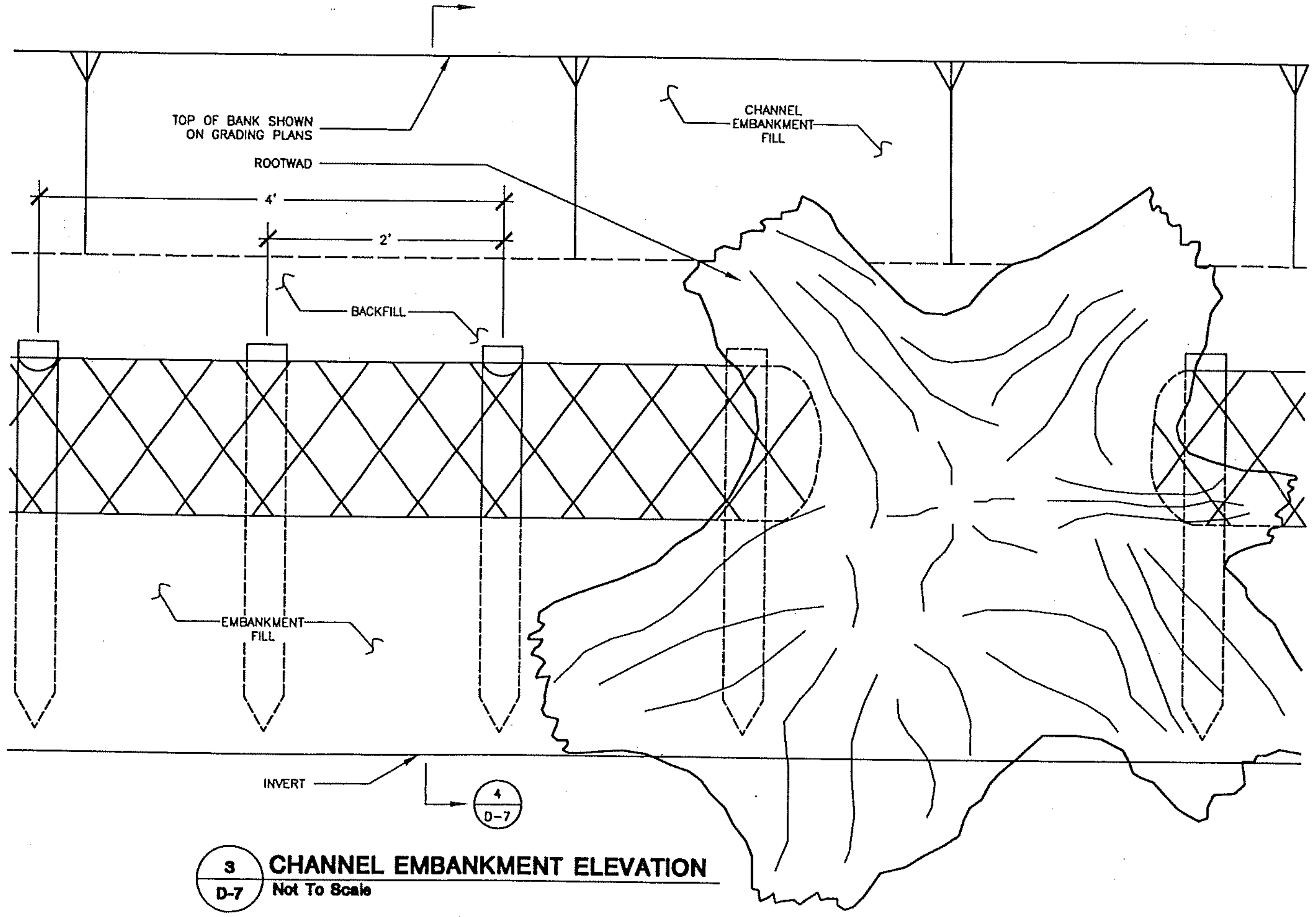
43 OF 47


APPROXIMATE LOW-FLOW WATER SURFACE
EXISTING GROUND REALIGNMENT SCENERIO 1
CUT
CUT
FINISHED GRADE
FILL
FILL
1.5' MIN.
FILL
CUT
2' MIN.
EXISTING GROUND REALIGNMENT SCENERIO 2
BENCH/BANK EMBANKMENT FILL (FILL) EXISTING SOIL (CUT)
5' STREAMBED FILL (FILL/CUT)
5' STREAMBED FILL (FILL/CUT)
10'
10' STREAMBED FILL (FILL/CUT) EXSTING STREAMBED (CUT)
FLOODPLAIN EMBANKMENT FILL (FILL) EXISTING SOIL (CUT)

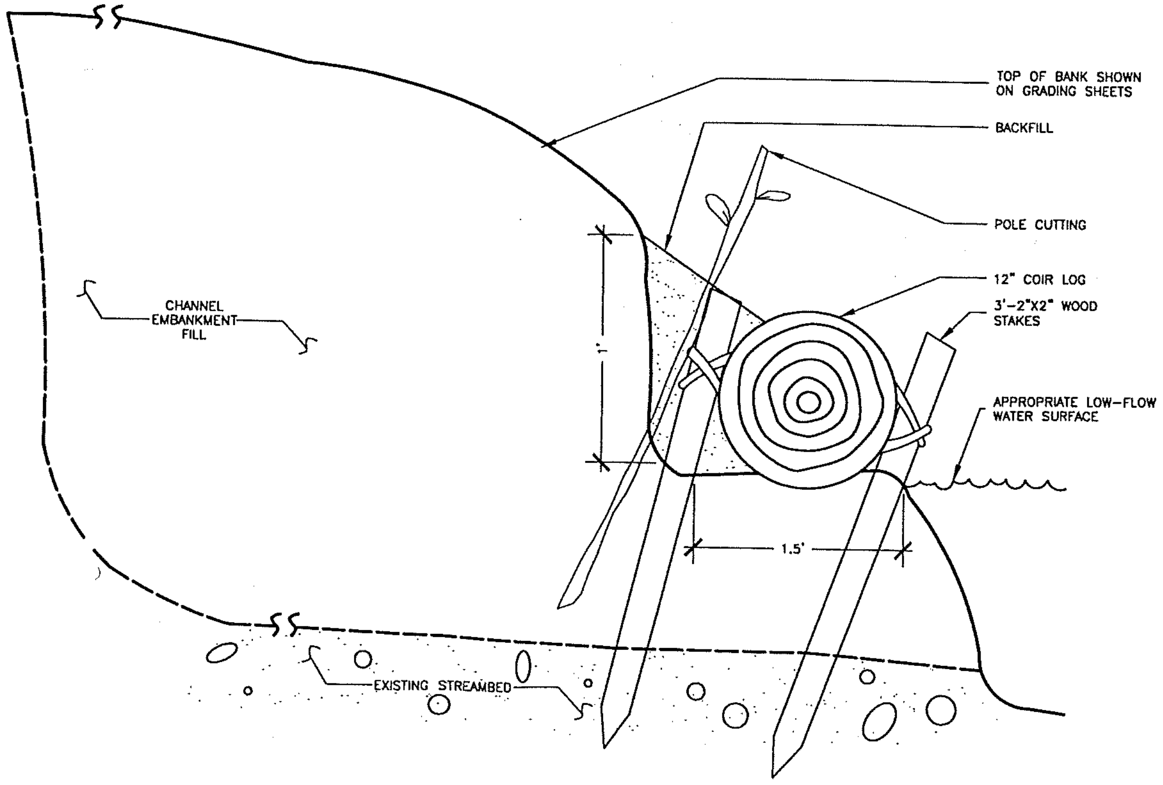
1 / D-7 **CHANNEL REALIGNMENT MATERIALS SCHEMATIC SECTION A**
Not To Scale


APPROXIMATE LOW-FLOW WATER SURFACE
EXISTING GROUND REALIGNMENT SCENERIO 1
CUT
CUT
FINISHED GRADE
FILL
1.5' MIN.
FILL
2' MIN.
EXISTING GROUND REALIGNMENT SCENERIO 2 -
BENCH/BANK EMBANKMENT FILL (FILL) EXISTING SOIL (CUT)
3' TO 5'
10' STREAMBED FILL (FILL/CUT)
3' TO 5' STREAMBED FILL (FILL/CUT)
FLOODPLAIN EMBANKMENT FILL (FILL) EXISTING SOIL (CUT)

2 / D-7 **CHANNEL REALIGNMENT MATERIALS SCHEMATIC SECTION C**
Not To Scale



3 / D-7 **CHANNEL EMBANKMENT ELEVATION**
Not To Scale



4 / D-7 **CHANNEL EMBANKMENT CONSTRUCTION**
Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

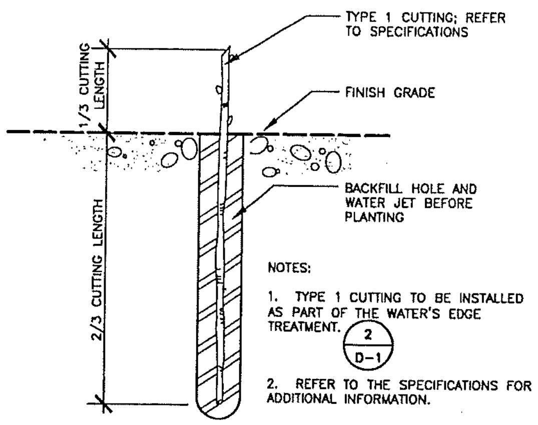
DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B.
CHECKED E.W./J.Z.

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK
RESTORATION PROJECT
CHANNEL REALIGNMENT DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN
SHEET
D-7
44 OF 47


TYPE 1 CUTTING; REFER TO SPECIFICATIONS
FINISH GRADE
BACKFILL HOLE AND WATER JET BEFORE PLANTING
1/3 CUTTING LENGTH
2/3 CUTTING LENGTH

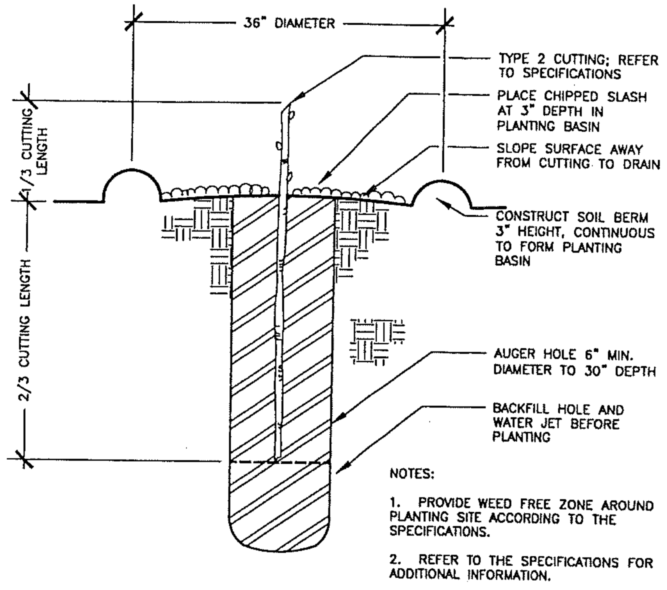
NOTES:

1. TYPE 1 CUTTING TO BE INSTALLED AS PART OF THE WATER'S EDGE TREATMENT. (2 / D-1)

2. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

1 / D-8 TYPE 1 CUTTING

Not To Scale


36" DIAMETER
TYPE 2 CUTTING; REFER TO SPECIFICATIONS
PLACE CHIPPED SLASH AT 3" DEPTH IN PLANTING BASIN
SLOPE SURFACE AWAY FROM CUTTING TO DRAIN
CONSTRUCT SOIL BERM 3" HEIGHT, CONTINUOUS TO FORM PLANTING BASIN
AUGER HOLE 6" MIN. DIAMETER TO 30" DEPTH
BACKFILL HOLE AND WATER JET BEFORE PLANTING
1/3 CUTTING LENGTH
2/3 CUTTING LENGTH

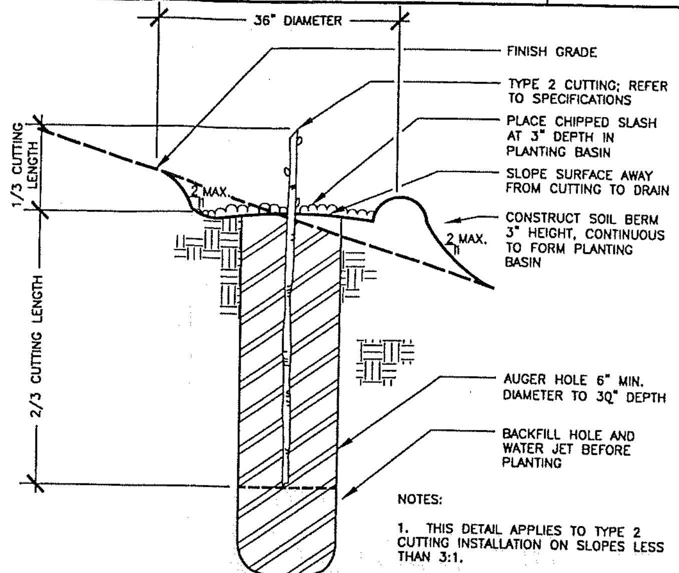
NOTES:

1. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

2. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

2 / D-8 TYPE 2 CUTTING ON BENCH

Not To Scale


36" DIAMETER
FINISH GRADE
TYPE 2 CUTTING; REFER TO SPECIFICATIONS
PLACE CHIPPED SLASH AT 3" DEPTH IN PLANTING BASIN
SLOPE SURFACE AWAY FROM CUTTING TO DRAIN
CONSTRUCT SOIL BERM 3" HEIGHT, CONTINUOUS TO FORM PLANTING BASIN
2 MAX.
1
AUGER HOLE 6" MIN. DIAMETER TO 30" DEPTH
BACKFILL HOLE AND WATER JET BEFORE PLANTING
1/3 CUTTING LENGTH
2/3 CUTTING LENGTH

NOTES:

1. THIS DETAIL APPLIES TO TYPE 2 CUTTING INSTALLATION ON SLOPES LESS THAN 3:1.

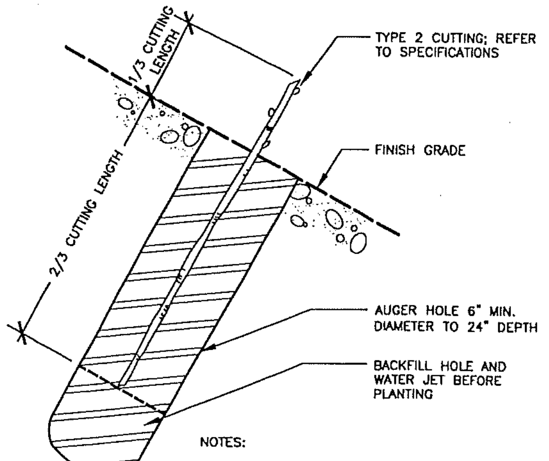
2. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

3. SOIL BERM SLOPE WILL BE NO GREATER THAN 2:1 HORIZONTAL TO VERTICAL.

4. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

3 / D-8 TYPE 2 CUTTING ON SLOPE

Not To Scale


TYPE 2 CUTTING; REFER TO SPECIFICATIONS
FINISH GRADE
AUGER HOLE 6" MIN. DIAMETER TO 24" DEPTH
BACKFILL HOLE AND WATER JET BEFORE PLANTING
1/3 CUTTING LENGTH
2/3 CUTTING LENGTH

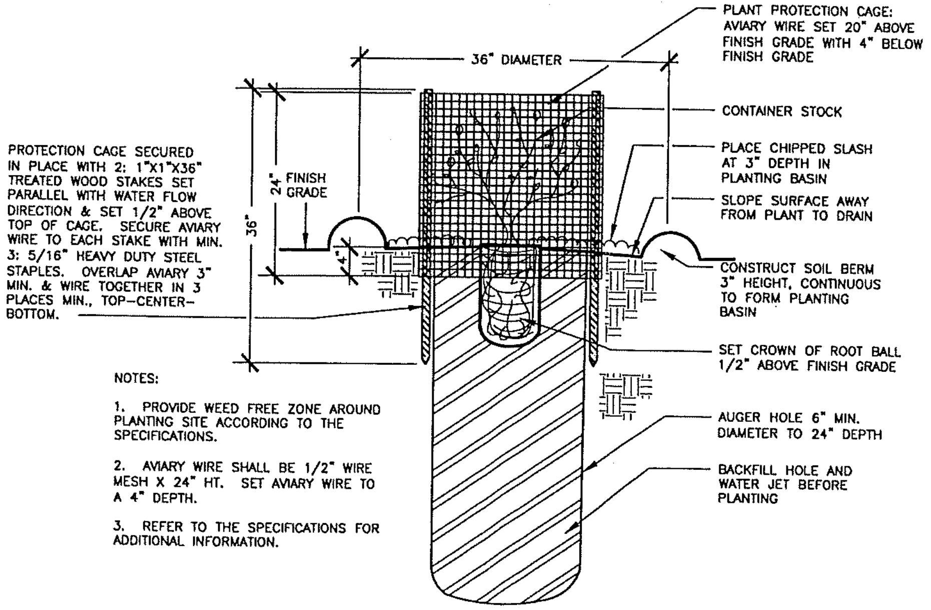
NOTES:

1. THIS DETAIL APPLIES TO TYPE 2 CUTTING INSTALLATION ON SLOPES GREATER THAN OR EQUAL TO 3:1.

2. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

4 / D-8 TYPE 2 CUTTING ON BANK

Not To Scale


36" DIAMETER
PLANT PROTECTION CAGE: AVIARY WIRE SET 20" ABOVE FINISH GRADE WITH 4" BELOW FINISH GRADE
CONTAINER STOCK
PLACE CHIPPED SLASH AT 3" DEPTH IN PLANTING BASIN
SLOPE SURFACE AWAY FROM PLANT TO DRAIN
CONSTRUCT SOIL BERM 3" HEIGHT, CONTINUOUS TO FORM PLANTING BASIN
SET CROWN OF ROOT BALL 1/2" ABOVE FINISH GRADE
AUGER HOLE 6" MIN. DIAMETER TO 24" DEPTH
BACKFILL HOLE AND WATER JET BEFORE PLANTING
PROTECTION CAGE SECURED IN PLACE WITH 2: 1"X1"X36" TREATED WOOD STAKES SET PARALLEL WITH WATER FLOW DIRECTION & SET 1/2" ABOVE TOP OF CAGE. SECURE AVIARY WIRE TO EACH STAKE WITH MIN. 3: 5/16" HEAVY DUTY STEEL STAPLES. OVERLAP AVIARY 3" MIN. & WIRE TOGETHER IN 3 PLACES MIN., TOP-CENTER-BOTTOM.
FINISH GRADE
24"
36"
4"

NOTES:

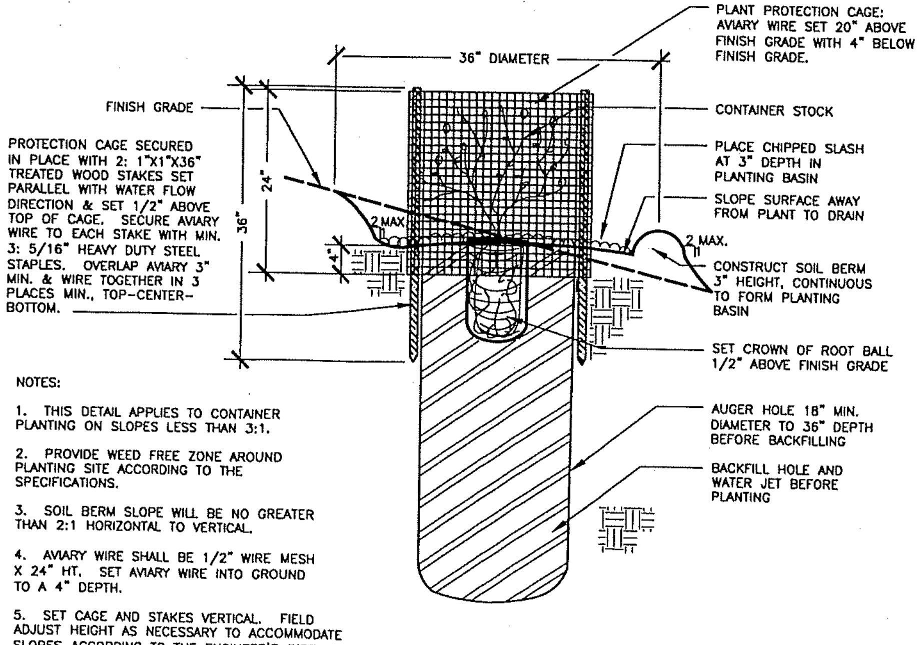
1. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

2. AVIARY WIRE SHALL BE 1/2" WIRE MESH X 24" HT. SET AVIARY WIRE TO A 4" DEPTH.

3. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

5 / D-8 CONTAINER PLANTING ON BENCH

Not To Scale


36" DIAMETER
PLANT PROTECTION CAGE: AVIARY WIRE SET 20" ABOVE FINISH GRADE WITH 4" BELOW FINISH GRADE.
FINISH GRADE
CONTAINER STOCK
PLACE CHIPPED SLASH AT 3" DEPTH IN PLANTING BASIN
SLOPE SURFACE AWAY FROM PLANT TO DRAIN
2 MAX.
1
CONSTRUCT SOIL BERM 3" HEIGHT, CONTINUOUS TO FORM PLANTING BASIN
SET CROWN OF ROOT BALL 1/2" ABOVE FINISH GRADE
AUGER HOLE 18" MIN. DIAMETER TO 36" DEPTH BEFORE BACKFILLING
BACKFILL HOLE AND WATER JET BEFORE PLANTING
PROTECTION CAGE SECURED IN PLACE WITH 2: 1"X1"X36" TREATED WOOD STAKES SET PARALLEL WITH WATER FLOW DIRECTION & SET 1/2" ABOVE TOP OF CAGE. SECURE AVIARY WIRE TO EACH STAKE WITH MIN. 3: 5/16" HEAVY DUTY STEEL STAPLES. OVERLAP AVIARY 3" MIN. & WIRE TOGETHER IN 3 PLACES MIN., TOP-CENTER-BOTTOM.
24"
36"
4"

NOTES:

1. THIS DETAIL APPLIES TO CONTAINER PLANTING ON SLOPES LESS THAN 3:1.

2. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

3. SOIL BERM SLOPE WILL BE NO GREATER THAN 2:1 HORIZONTAL TO VERTICAL.

4. AVIARY WIRE SHALL BE 1/2" WIRE MESH X 24" HT. SET AVIARY WIRE INTO GROUND TO A 4" DEPTH.

5. SET CAGE AND STAKES VERTICAL. FIELD ADJUST HEIGHT AS NECESSARY TO ACCOMMODATE SLOPES ACCORDING TO THE ENGINEER'S DIRECTION.

6. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

6 / D-8 CONTAINER PLANTING ON SLOPE

Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE	7/17/00
DESIGN	A.R./E.W.
DRAWN	S.A.B.
CHECKED	E.W./J.Z.

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

DATE

GUADALUPE CREEK RESTORATION PROJECT

PLANTING DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE
AS SHOWN

SHEET
D-8
45 OF 47

PROTECTION CAGE SECURED IN PLACE WITH 2: 1"X1"X36" TREATED WOOD STAKES SET PARALLEL WITH WATER FLOW DIRECTION & SET 1/2" ABOVE TOP OF CAGE. SECURE AVIARY WIRE TO EACH STAKE WITH MIN. 3: 5/16" HEAVY DUTY STEEL STAPLES. OVERLAP AVIARY 3" MIN. & WIRE TOGETHER IN 3 PLACES MIN., TOP-CENTER-BOTTOM.

NOTES:

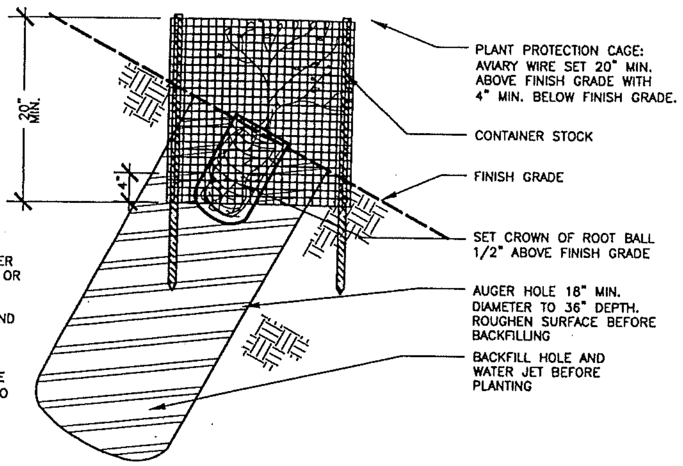
1. THIS DETAIL APPLIES TO CONTAINER PLANTING ON SLOPES GREATER THAN OR EQUAL TO 3:1.

2. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

3. AVIARY WIRE SHALL BE 1/2" WIRE MESH X 24" HT. SET AVIARY WIRE TO A 4" DEPTH.

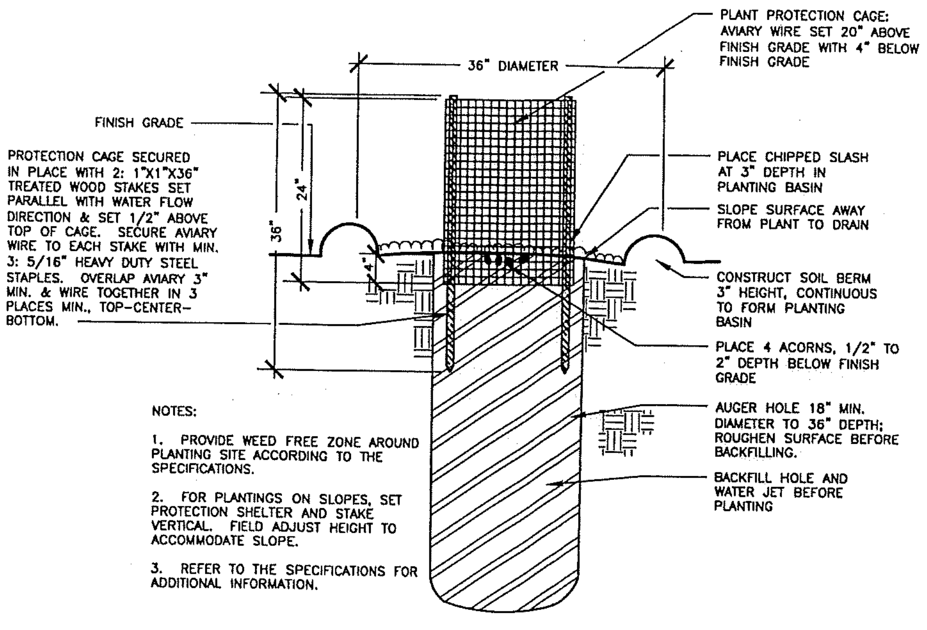
4. SET CAGE AND STAKES VERTICAL TO SLOPE. FIELD ADJUST HEIGHT AS NECESSARY TO ACCOMMODATE SLOPES ACCORDING TO THE ENGINEER'S DIRECTION.

5. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.


20" MIN.
4"
PLANT PROTECTION CAGE: AVIARY WIRE SET 20" MIN. ABOVE FINISH GRADE WITH 4" MIN. BELOW FINISH GRADE.
CONTAINER STOCK
FINISH GRADE
SET CROWN OF ROOT BALL 1/2" ABOVE FINISH GRADE
AUGER HOLE 18" MIN. DIAMETER TO 36" DEPTH. ROUGHEN SURFACE BEFORE BACKFILLING
BACKFILL HOLE AND WATER JET BEFORE PLANTING

1 D-9 CONTAINER PLANTING ON BANK

Not To Scale


36" DIAMETER
FINISH GRADE
24"
36"
4"
PLANT PROTECTION CAGE: AVIARY WIRE SET 20" ABOVE FINISH GRADE WITH 4" BELOW FINISH GRADE
PLACE CHIPPED SLASH AT 3" DEPTH IN PLANTING BASIN
SLOPE SURFACE AWAY FROM PLANT TO DRAIN
CONSTRUCT SOIL BERM 3" HEIGHT, CONTINUOUS TO FORM PLANTING BASIN
PLACE 4 ACORNS, 1/2" TO 2" DEPTH BELOW FINISH GRADE
AUGER HOLE 18" MIN. DIAMETER TO 36" DEPTH; ROUGHEN SURFACE BEFORE BACKFILLING.
BACKFILL HOLE AND WATER JET BEFORE PLANTING
PROTECTION CAGE SECURED IN PLACE WITH 2: 1"X1"X36" TREATED WOOD STAKES SET PARALLEL WITH WATER FLOW DIRECTION & SET 1/2" ABOVE TOP OF CAGE. SECURE AVIARY WIRE TO EACH STAKE WITH MIN. 3: 5/16" HEAVY DUTY STEEL STAPLES. OVERLAP AVIARY 3" MIN. & WIRE TOGETHER IN 3 PLACES MIN., TOP-CENTER-BOTTOM.

NOTES:

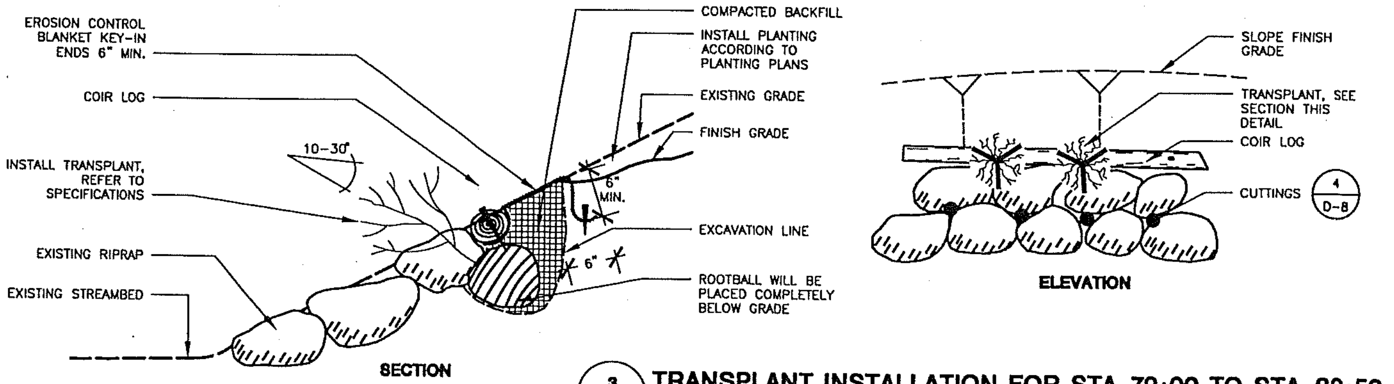
1. PROVIDE WEED FREE ZONE AROUND PLANTING SITE ACCORDING TO THE SPECIFICATIONS.

2. FOR PLANTINGS ON SLOPES, SET PROTECTION SHELTER AND STAKE VERTICAL. FIELD ADJUST HEIGHT TO ACCOMMODATE SLOPE.

3. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION.

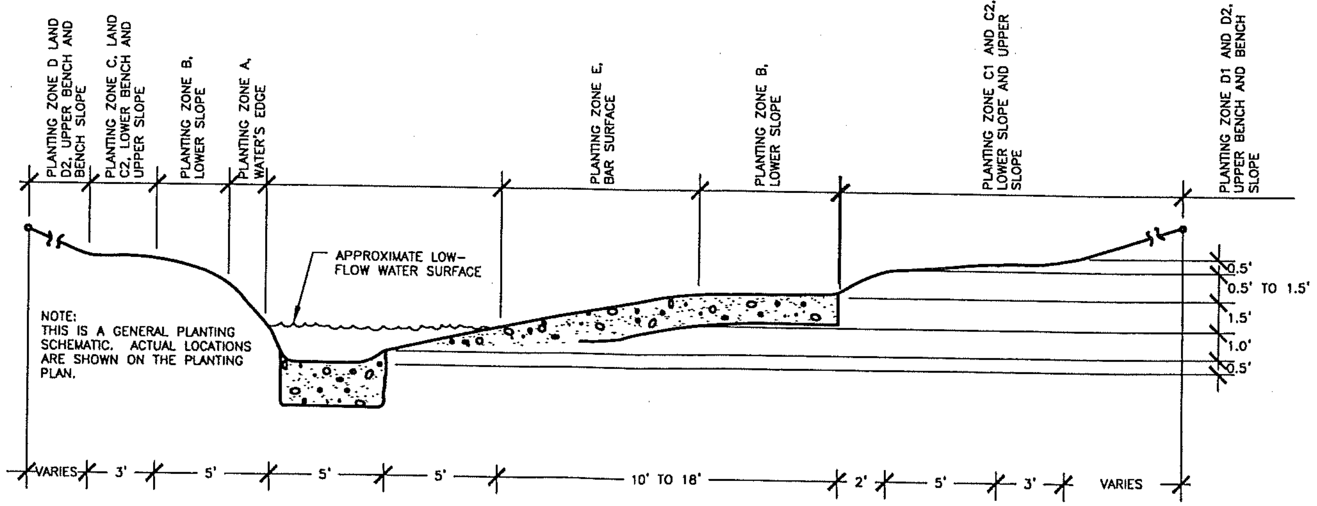
2 D-9 ACORN PLANTING

Not To Scale


EROSION CONTROL BLANKET KEY-IN ENDS 6" MIN.
COIR LOG
INSTALL TRANSPLANT, REFER TO SPECIFICATIONS
EXISTING RIPRAP
EXISTING STREAMBED
10-30°
COMPACTED BACKFILL
INSTALL PLANTING ACCORDING TO PLANTING PLANS
EXISTING GRADE
FINISH GRADE
6" MIN.
6"
EXCAVATION LINE
ROOTBALL WILL BE PLACED COMPLETELY BELOW GRADE
SECTION
SLOPE FINISH GRADE
TRANSPLANT, SEE SECTION THIS DETAIL
COIR LOG
CUTTINGS
4 D-8
ELEVATION

3 D-9 TRANSPLANT INSTALLATION FOR STA. 79+00 TO STA. 89+50

Not To Scale


PLANTING ZONE D LAND D2, UPPER BENCH AND BENCH SLOPE
PLANTING ZONE C, LAND C2, LOWER BENCH AND UPPER SLOPE
PLANTING ZONE B, LOWER SLOPE
PLANTING ZONE A, WATER'S EDGE
PLANTING ZONE E, BAR SURFACE
PLANTING ZONE B, LOWER SLOPE
PLANTING ZONE C1 AND C2, LOWER SLOPE AND UPPER SLOPE
PLANTING ZONE D1 AND D2, UPPER BENCH AND BENCH SLOPE
APPROXIMATE LOW-FLOW WATER SURFACE
0.5'
0.5' TO 1.5'
1.5'
1.0'
0.5'
VARIES
3'
5'
5'
5'
10' TO 18'
2'
5'
3'
VARIES

NOTE:
THIS IS A GENERAL PLANTING SCHEMATIC. ACTUAL LOCATIONS ARE SHOWN ON THE PLANTING PLAN.

4 D-9 PLANTING ZONES

Not To Scale SECTION LOOKING UPSTREAM

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 Industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B
CHECKED E.W./J.Z.

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
DATE

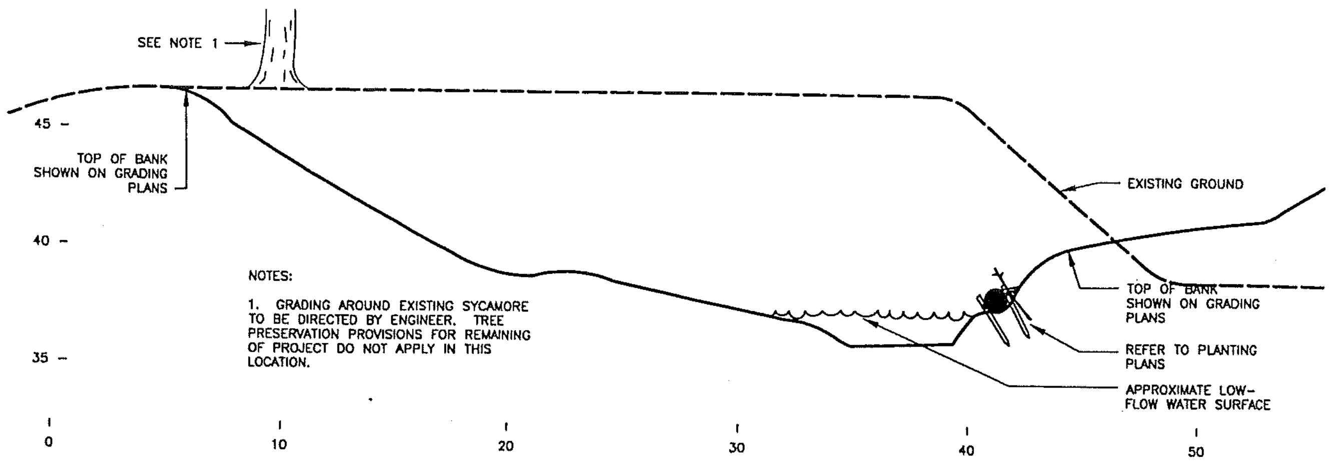
GUADALUPE CREEK RESTORATION PROJECT

PLANTING DETAILS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

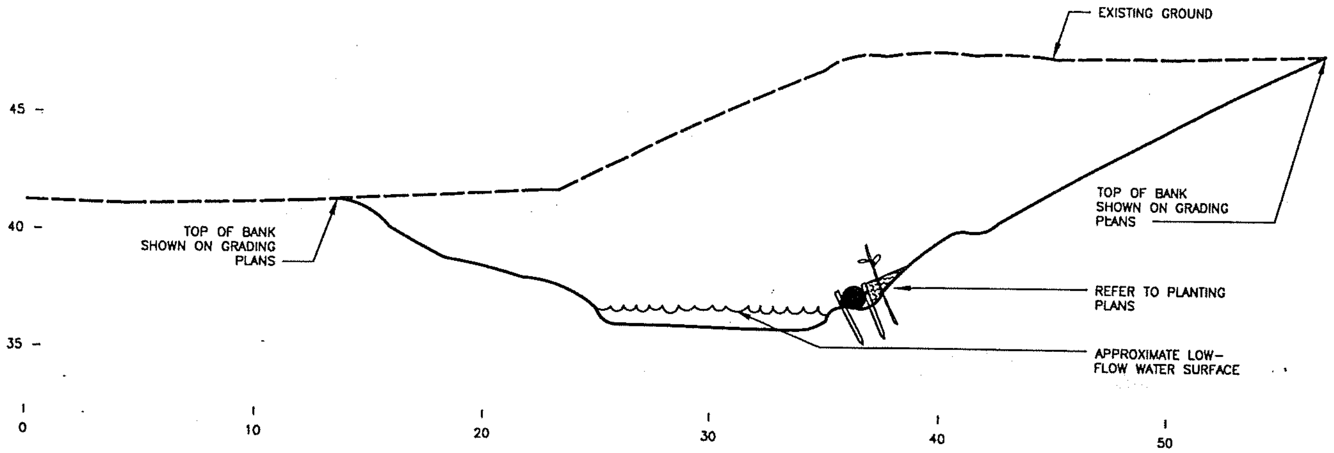
SHEET D-9
46 OF 47


SEE NOTE 1
45 –
40 –
35 –
TOP OF BANK SHOWN ON GRADING PLANS
EXISTING GROUND
TOP OF BANK SHOWN ON GRADING PLANS
REFER TO PLANTING PLANS
APPROXIMATE LOW-FLOW WATER SURFACE
0
10
20
30
40
50

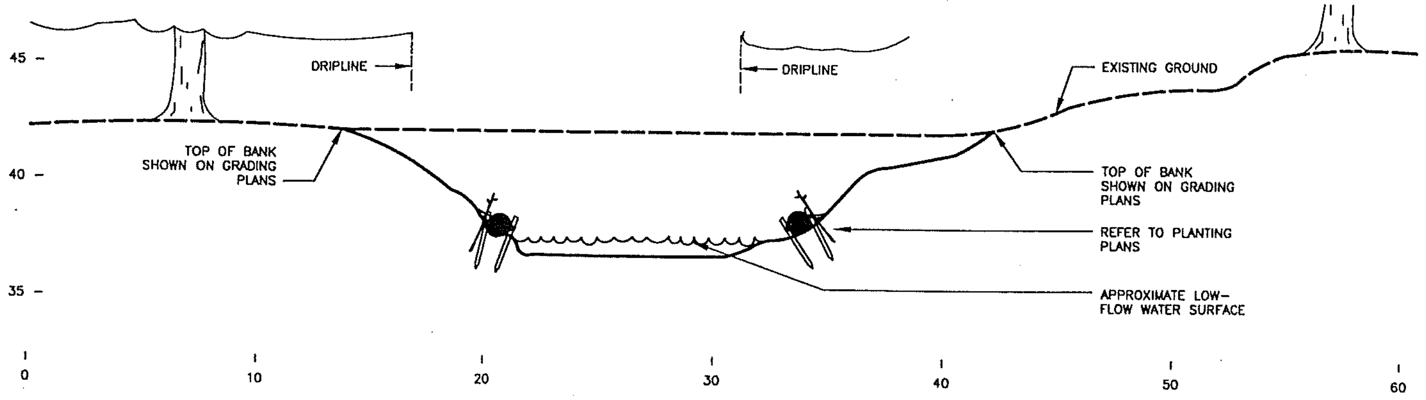
NOTES:

1. GRADING AROUND EXISTING SYCAMORE TO BE DIRECTED BY ENGINEER. TREE PRESERVATION PROVISIONS FOR REMAINING OF PROJECT DO NOT APPLY IN THIS LOCATION.

1 / XS-1 **STATION 71+96**
Not To Scale


EXISTING GROUND
45 –
40 –
35 –
TOP OF BANK SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
REFER TO PLANTING PLANS
APPROXIMATE LOW-FLOW WATER SURFACE
0
10
20
30
40
50

2 / XS-1 **STATION 72+94**
Not To Scale


45 –
40 –
35 –
DRIPLINE
DRIPLINE
EXISTING GROUND
TOP OF BANK SHOWN ON GRADING PLANS
TOP OF BANK SHOWN ON GRADING PLANS
REFER TO PLANTING PLANS
APPROXIMATE LOW-FLOW WATER SURFACE
0
10
20
30
40
50
60

3 / XS-1 **STATION 73+38**
Not To Scale

REV	DESCRIPTION	DATE	APPR
	DRAFT SUBMITTAL NOT FOR CONSTRUCTION		

Jones & Stokes
2880 Zanker Rd., San Jose, CA 95134

nhc
northwest hydraulic consultants, inc.
3950 industrial boulevard, suite 100c
west sacramento, california 95691-3430

CONSULTANT STAMP

CONSULTANT STAMP

DATE 7/17/00
DESIGN A.R./E.W.
DRAWN S.A.B
CHECKED E.W./J.Z.

Santa Clara Valley Water District

ACCEPTED BY DISTRICT
DATE

GUADALUPE CREEK RESTORATION PROJECT

CROSS SECTIONS

VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

SCALE AS SHOWN

SHEET
XS-1
47 OF 47

Appendix D. Cost Estimates for Project Alternatives and Recommended Project

Construction Cost Estimate for the Recommended Project

Item No.	Description of Bid Item	Approximate Quantity	Unit	Unit Price	Total
1	Storm Water Pollution Prevention Plan	1	Lump Sum	$50,000.00	$50,000
2	Mobilization /Demobilization	1	Lump Sum	$130,000.00	$130,000
3	Preservation Fencing	20,000	Linear Foot	$5.00	$100,000
4	Individual Plant Removal	1	Lump Sum	$30,000.00	$30,000
5	Cluster Plant Removal	91,000	Square Foot	$0.50	$45,500
6	Existing Tree Excavation for Transplanting	152	Each	$850.00	$129,200
7	Existing Tree Excavation for Reuse as Instream Woody Material	2	Each	$1,000.00	$2,000
8	Asphaltic Concrete Removal	1	Lump Sum	$3,000.00	$3,000
9	Existing Concrete Slope Protection Removal	24	Ton	$100.00	$2,400
10	Control of Water (Coordination with District)	1	Lump Sum	$15,000.00	$15,000
11	Channel Excavation	17,000	Ton	$6.00	$102,000
12	Bank and Bench Excavation	71,000	Ton	$3.00	$213,000
13	Instream Structure Excavation	7,000	Ton	$9.00	$63,000
14	Type 3 Boulder Removal and Salvage	200	Each	$30.00	$6,000
15	Soil Disposal	46,200	Ton	$16.50	$762,300
16	Toxic Constituent Disposal	38,000	Ton	$65.00	$2,470,000
17	Soil Loosening	300,000	Square Foot	$0.04	$12,000
18	Channel Embankment Construction	5,000	Ton	$30.00	$150,000
19	Bench Construction	3,700	Ton	$35.00	$129,500
20	Streambed Construction	7,300	Ton	$36.00	$262,800
21	Bar Construction	5,000	Square Foot	$3.00	$15,000
22	Topsoil Fill	6,000	Ton	$18.00	$108,000
23	Bank Protection	750	Linear Foot	$270.00	$202,500
24	Rock Slope Protection	100	Ton	$45.00	$4,500
25	Percolation Pond Construction	1	Lump Sum	$250,000.00	$250,000
26	Infrastructure Modifications	1	Lump Sum	$50,000.00	$50,000
27	Stream Boulder Placement	150	Each	$35.00	$5,250
28	Cross Weir	15	Each	$5,000.00	$75,000

29	V-Weirs	10	Each	$4,500.00	$45,000
30	Wing Deflector	4	Each	$1,500.00	$6,000
31	Log Stream Barb	30	Each	$1,400.00	$42,000
32	Rock Stream Barbs	24	Each	$2,200.00	$52,800
33	Waters Edge Treatment	3,000	Linear Foot	$20.00	$60,000
34	Buried Groins	335	Ton	$75.00	$25,125
35	Rootwad Bank Structure - Type 1	71	Each	$2,800.00	$198,800
36	Rootwad Bank Structure - Type 2	9	Each	$2,700.00	$24,300
37	Bar IWM	150	Each	$850.00	$127,500
38	Stream IWM	9	Each	$800.00	$7,200
39	Overbank Woody Material	12	Each	$2,300.00	$27,600
40	Log Toe Bank Structure	18	Each	$2,000.00	$36,000
41	Off-bank Branch Cover	45	Each	$800.00	$36,000
42	Off-bank Log Cover	8	Each	$800.00	$6,400
43	Remove, Salvage, and Reinstall Chain Link Fence	800	Linear Foot	$20.00	$16,000
44	Chain Link Fence	120	Linear Foot	$25.00	$3,000
45	Water Service Point	2	Each	$20,000.00	$40,000
46	Meter	2	Each	$5,000.00	$10,000
47	Backflow Assembly	2	Each	$8,000.00	$16,000
48	Main Line	18,000	Linear Foot	$12.00	$216,000
49	Bubbler Irrigation System	300,000	Square Foot	$1.50	$450,000
50	Supplemental Watering (Construction Period)	4	Per Event	$5,000.00	$20,000
51	Type 1 Cutting Collection and Storage	3,715	Each	$5.00	$18,575
52	Type 2 Cutting Collection and Storage	2,023	Each	$5.00	$10,115
53	Type 1 Cutting Installation	3,715	Each	$12.00	$44,580
54	Type 2 Cutting Installation on Bench	445	Each	$15.00	$6,675
55	Type 2 Cutting Installation on Slope	772	Each	$15.00	$11,580
56	Type 2 Cutting Installation on Bank	806	Each	$12.00	$9,672
57	Brush Layer Collection and Storage	100	Each	$20.00	$2,000
58	Brush Layer Installation	100	Each	$50.00	$5,000

59	Willow Wattles (20-foot lengths)	20	Each	$2,500.00	$50,000
60	Container Plant Installation on Bench	5,122	Each	$15.00	$76,830
61	Container Plant Installation on Slope	3,895	Each	$15.00	$58,425
62	Container Plant Installation on Bank	1,297	Each	$15.00	$19,455
63	Acorn Planting	206	Each	$12.00	$2,472
64	Transplanting	152	Each	$1,000.00	$152,000
65	Seeding	20	Acre	$2,000.00	$40,000
66	Weed Control (3-year Maintenance Period)	12	Month	$5,000.00	$60,000
67	Irrigation Operation (3-yearMaintenance Period)	21	Month	$1,200.00	$25,200
68	Supplemental Watering (3-yearMaintenance Period)	18	Per Event	$5,000.00	$90,000
69	Replacement Planting (3-yearMaintenance Period)	5500	Each	$25.00	$137,500
70	Reseeding (Maintenance Period)	275,000	Square Foot	$0.05	$13,750
71	Plant Establishment Forms	36	Each	$500.00	$18,000
72	Record Drawings	1	Set	$15,000.00	$15,000
Subtotal					$7,720,500
Quantity and Unit Cost Contingency					$772,050
Total Estimated Cost					**$8,492,550**

Notes:

This cost estimate is based on the Draft Submittal Construction Documents (i.e., plans & specifications) prepared by Jones & Stokes and Northwest Hydraulic Consultants, dated July 19, 2000, and conceptual changes developed for the recommended project based on comments received form District staff.

This cost estimate does not include subsequent phases of the project.

This cost estimate is a planning tool to assess the level of effort required to perform the work. This estimate is preliminary, and actual costs may vary by an order of magnitude. Actual construction costs may vary from the above estimates because of competitive bidding, negotiations with the Santa Clara Valley Water District, or fluctuations in market prices. This estimate is not a bid.

Total costs have been rounded off for order-of-magnitude purposes.

This estimate does not include contingencies for soil disposal and soil management relating to hazardous materials that may be found onsite. Based on existing data, this estimate assumes that 40% of the material will be disposed of at a Class II or Class III facility.

This estimate assumes that the District will be responsible for control of water, including dewatering the creek and rerouting flows through the Los Capitancillos percolation pond system.

Construction Cost Estimate for Alternative 1

Item No.	Description of Bid Item	Approximate Quantity	Unit	Unit Price	Total
1	Storm Water Pollution Prevention Plan	1	Lump Sum	$50,000.00	$50,000
2	Mobilization /Demobilization	1	Lump Sum	$104,000.00	$104,000
3	Preservation Fencing	20,000	Linear Foot	$5.00	$100,000
4	Individual Plant Removal	1	Lump Sum	$24,000.00	$19,200
5	Cluster Plant Removal	91,000	Square Foot	$0.50	$45,500
6	Existing Tree Excavation for Transplanting	122	Each	$850.00	$103,360
7	Existing Tree Excavation for Reuse as Instream Woody Material	2	Each	$1,000.00	$2,000
8	Asphaltic Concrete Removal	1	Lump Sum	$3,000.00	$3,000
9	Existing Concrete Slope Protection Removal	24	Ton	$100.00	$2,400
10	Control of Water (Coordination with District)	1	Lump Sum	$15,000.00	$15,000
11	Channel Excavation	12,750	Ton	$6.00	$76,500
12	Bank and Bench Excavation	53,250	Ton	$3.00	$159,750
13	Instream Structure Excavation	5,250	Ton	$9.00	$47,250
14	Type 3 Boulder Removal and Salvage	200	Each	$30.00	$6,000
15	Soil Disposal	34,650	Ton	$16.50	$571,725
16	Toxic Constituent Disposal	28,500	Ton	$65.00	$1,852,500
17	Soil Loosening	240,000	Square Foot	$0.04	$9,600
18	Channel Embankment Construction	3,750	Ton	$30.00	$112,500
19	Bench Construction	2,775	Ton	$35.00	$97,125
20	Streambed Construction	5,475	Ton	$36.00	$197,100
21	Bar Construction	3,750	Square Foot	$3.00	$11,250
22	Topsoil Fill	4,500	Ton	$18.00	$81,000
23	Bank Protection	1,095	Linear Foot	$270.00	$295,650
24	Rock Slope Protection	150	Ton	$45.00	$6,750
25	Percolation Pond Construction	1	Lump Sum	$250,000.00	$250,000
26	Infrastructure Modifications	1	Lump Sum	$50,000.00	$50,000
27	Stream Boulder Placement	150	Each	$35.00	$5,250
28	Cross Weir	15	Each	$5,000.00	$75,000

29	V-Weirs	10	Each	$4,500.00	$45,000
30	Wing Deflector	4	Each	$1,500.00	$6,000
31	Log Stream Barb	15	Each	$1,400.00	$21,000
32	Rock Stream Barbs	20	Each	$2,200.00	$44,000
33	Waters Edge Treatment	3,000	Linear Foot	$20.00	$60,000
34	Buried Groins	251	Ton	$75.00	$18,844
35	Rootwad Bank Structure - Type 1	36	Each	$2,800.00	$99,400
36	Rootwad Bank Structure - Type 2	9	Each	$2,700.00	$24,300
37	Bar IWM	125	Each	$850.00	$106,250
38	Stream IWM	9	Each	$800.00	$7,200
39	Overbank Woody Material	12	Each	$2,300.00	$27,600
40	Log Toe Bank Structure	18	Each	$2,000.00	$36,000
41	Off-bank Branch Cover	45	Each	$800.00	$36,000
42	Off-bank Log Cover	8	Each	$800.00	$6,400
43	Remove, Salvage, and Reinstall Chain Link Fence	800	Linear Foot	$20.00	$16,000
44	Chain Link Fence	120	Linear Foot	$25.00	$3,000
45	Water Service Point	2	Each	$20,000.00	$40,000
46	Meter	2	Each	$5,000.00	$10,000
47	Backflow Assembly	2	Each	$8,000.00	$16,000
48	Main Line	18,000	Linear Foot	$12.00	$216,000
49	Bubbler Irrigation System	200,000	Square Foot	$1.50	$300,000
50	Supplemental Watering (Construction Period)	4	Per Event	$5,000.00	$20,000
51	Type 1 Cutting Collection and Storage	2,601	Each	$5.00	$13,003
52	Type 2 Cutting Collection and Storage	1,416	Each	$5.00	$7,081
53	Type 1 Cutting Installation	2,601	Each	$12.00	$31,206
54	Type 2 Cutting Installation on Bench	312	Each	$15.00	$4,673
55	Type 2 Cutting Installation on Slope	540	Each	$15.00	$8,106
56	Type 2 Cutting Installation on Bank	564	Each	$12.00	$6,770
57	Brush Layer Collection and Storage	100	Each	$20.00	$2,000
58	Brush Layer Installation	100	Each	$50.00	$5,000

59	Willow Wattles (20-foot lengths)	20	Each	$2,500.00	$50,000
60	Container Plant Installation on Bench	3,585	Each	$15.00	$53,781
61	Container Plant Installation on Slope	2,727	Each	$15.00	$40,898
62	Container Plant Installation on Bank	908	Each	$15.00	$13,619
63	Acorn Planting	144	Each	$12.00	$1,730
64	Transplanting	122	Each	$1,000.00	$121,600
65	Seeding	20	Acre	$2,000.00	$40,000
66	Weed Control (3-year Maintenance Period)	12	Month	$5,000.00	$60,000
67	Irrigation Operation (3-yearMaintenance Period)	21	Month	$1,200.00	$25,200
68	Supplemental Watering (3-yearMaintenance Period)	18	Per Event	$3,500.00	$63,000
69	Replacement Planting (3-yearMaintenance Period)	3850	Each	$25.00	$96,250
70	Reseeding (Maintenance Period)	275,000	Square Foot	$0.05	$13,750
71	Plant Establishment Forms	36	Each	$500.00	$18,000
72	Record Drawings	1	Set	$15,000.00	$15,000

Subtotal	$6,199,100
Quantity and Unit Cost Contingency	$619,910
Total Estimated Cost	**$6,819,010**

Notes:

This cost estimate is based on the Draft Submittal Construction Documents (i.e., plans & specifications) prepared by Jones & Stokes and Northwest Hydraulic Consultants, dated July 19, 2000, and conceptual changes developed for the recommended project based on comments received form District staff.

This cost estimate does not include subsequent phases of the project.

This cost estimate is a planning tool to assess the level of effort required to perform the work. This estimate is preliminary, and actual costs may vary by an order of magnitude. Actual construction costs may vary from the above estimates because of competitive bidding, negotiations with the Santa Clara Valley Water District, or fluctuations in market prices. This estimate is not a bid.

Total costs have been rounded off for order-of-magnitude purposes.

This estimate does not include contingencies for soil disposal and soil management relating to hazardous materials that may be found onsite. Based on existing data, this estimate assumes that 40% of the material will be disposed of at a Class II or Class III facility.

This estimate assumes that the District will be responsible for control of water, including dewatering the creek and rerouting flows through the Los Capitancillos percolation pond system.

Construction Cost Estimate for Alternative 2

Item No.	Description of Bid Item	Approximate Quantity	Unit	Unit Price	Total
1	Storm Water Pollution Prevention Plan	1	Lump Sum	$50,000.00	$50,000
2	Mobilization /Demobilization	1	Lump Sum	$78,000.00	$78,000
3	Preservation Fencing	20,000	Linear Foot	$5.00	$100,000
4	Individual Plant Removal	1	Lump Sum	$18,000.00	$14,400
5	Cluster Plant Removal	91,000	Square Foot	$0.50	$45,500
6	Existing Tree Excavation for Transplanting	91	Each	$850.00	$77,520
7	Existing Tree Excavation for Reuse as Instream Woody Material	2	Each	$1,000.00	$2,000
8	Asphaltic Concrete Removal	1	Lump Sum	$3,000.00	$3,000
9	Existing Concrete Slope Protection Removal	0	Ton	$100.00	$0
10	Control of Water (Coordination with District)	1	Lump Sum	$15,000.00	$15,000
11	Channel Excavation	6,800	Ton	$6.00	$40,800
12	Bank and Bench Excavation	28,400	Ton	$3.00	$85,200
13	Instream Structure Excavation	2,800	Ton	$9.00	$25,200
14	Type 3 Boulder Removal and Salvage	200	Each	$30.00	$6,000
15	Soil Disposal	18,480	Ton	$16.50	$304,920
16	Toxic Constituent Disposal	15,200	Ton	$65.00	$988,000
17	Soil Loosening	180,000	Square Foot	$0.04	$7,200
18	Channel Embankment Construction	2,000	Ton	$30.00	$60,000
19	Bench Construction	1,480	Ton	$35.00	$51,800
20	Streambed Construction	2,920	Ton	$36.00	$105,120
21	Bar Construction	2,000	Square Foot	$3.00	$6,000
22	Topsoil Fill	2,400	Ton	$18.00	$43,200
23	Bank Protection	1,285	Linear Foot	$270.00	$346,950
24	Rock Slope Protection	175	Ton	$45.00	$7,875
25	Percolation Pond Construction	0	Lump Sum	$250,000.00	$0
26	Infrastructure Modifications	0	Lump Sum	$50,000.00	$0
27	Stream Boulder Placement	150	Each	$35.00	$5,250
28	Cross Weir	18	Each	$5,000.00	$90,000

29	V-Weirs	10	Each	$4,500.00	$45,000
30	Wing Deflector	4	Each	$1,500.00	$6,000
31	Log Stream Barb	20	Each	$1,400.00	$28,000
32	Rock Stream Barbs	20	Each	$2,200.00	$44,000
33	Waters Edge Treatment	3,000	Linear Foot	$20.00	$60,000
34	Buried Groins	268	Ton	$75.00	$20,100
35	Rootwad Bank Structure - Type 1	36	Each	$2,800.00	$99,400
36	Rootwad Bank Structure - Type 2	9	Each	$2,700.00	$24,300
37	Bar IWM	125	Each	$850.00	$106,250
38	Stream IWM	9	Each	$800.00	$7,200
39	Overbank Woody Material	12	Each	$2,300.00	$27,600
40	Log Toe Bank Structure	18	Each	$2,000.00	$36,000
41	Off-bank Branch Cover	45	Each	$800.00	$36,000
42	Off-bank Log Cover	8	Each	$800.00	$6,400
43	Remove, Salvage, and Reinstall Chain Link Fence	0	Linear Foot	$20.00	$0
44	Chain Link Fence	0	Linear Foot	$25.00	$0
45	Water Service Point	2	Each	$20,000.00	$40,000
46	Meter	2	Each	$5,000.00	$10,000
47	Backflow Assembly	2	Each	$8,000.00	$16,000
48	Main Line	18,000	Linear Foot	$12.00	$216,000
49	Bubbler Irrigation System	110,000	Square Foot	$1.50	$165,000
50	Supplemental Watering (Construction Period)	4	Per Event	$5,000.00	$20,000
51	Type 1 Cutting Collection and Storage	1,486	Each	$5.00	$7,430
52	Type 2 Cutting Collection and Storage	809	Each	$5.00	$4,046
53	Type 1 Cutting Installation	1,486	Each	$12.00	$17,832
54	Type 2 Cutting Installation on Bench	178	Each	$15.00	$2,670
55	Type 2 Cutting Installation on Slope	309	Each	$15.00	$4,632
56	Type 2 Cutting Installation on Bank	322	Each	$12.00	$3,869
57	Brush Layer Collection and Storage	100	Each	$20.00	$2,000
58	Brush Layer Installation	100	Each	$50.00	$5,000

59	Willow Wattles (20-foot lengths)	20	Each	$2,500.00	$50,000
60	Container Plant Installation on Bench	2,049	Each	$15.00	$30,732
61	Container Plant Installation on Slope	1,558	Each	$15.00	$23,370
62	Container Plant Installation on Bank	519	Each	$15.00	$7,782
63	Acorn Planting	82	Each	$12.00	$989
64	Transplanting	91	Each	$1,000.00	$91,200
65	Seeding	20	Acre	$2,000.00	$40,000
66	Weed Control (3-year Maintenance Period)	12	Month	$5,000.00	$60,000
67	Irrigation Operation (3-yearMaintenance Period)	21	Month	$1,200.00	$25,200
68	Supplemental Watering (3-yearMaintenance Period)	18	Per Event	$2,000.00	$36,000
69	Replacement Planting (3-yearMaintenance Period)	2200	Each	$25.00	$55,000
70	Reseeding (Maintenance Period)	275,000	Square Foot	$0.05	$13,750
71	Plant Establishment Forms	36	Each	$500.00	$18,000
72	Record Drawings	1	Set	$15,000.00	$15,000

Subtotal	$4,086,700
Quantity and Unit Cost Contingency	$408,670
Total Estimated Cost	**$4,495,370**

Notes:

This cost estimate is based on the Draft Submittal Construction Documents (i.e., plans & specifications) prepared by Jones & Stokes and Northwest Hydraulic Consultants, dated July 19, 2000, and conceptual changes developed for the recommended project based on comments received form District staff.

This cost estimate does not include subsequent phases of the project.

This cost estimate is a planning tool to assess the level of effort required to perform the work. This estimate is preliminary, and actual costs may vary by an order of magnitude. Actual construction costs may vary from the above estimates because of competitive bidding, negotiations with the Santa Clara Valley Water District, or fluctuations in market prices. This estimate is not a bid.

Total costs have been rounded off for order-of-magnitude purposes.

This estimate does not include contingencies for soil disposal and soil management relating to hazardous materials that may be found onsite. Based on existing data, this estimate assumes that 40% of the material will be disposed of at a Class II or Class III facility.

This estimate assumes that the District will be responsible for control of water, including dewatering the creek and rerouting flows through the Los Capitancillos percolation pond system.